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Buy a Liberty Bond

WHILE everyone connected with the shipbuilding or shipping industries in this crisis is rendering a service to his country of no less importance and value than that of men in the trenches, nevertheless no one should lose sight of the fact that his responsibilities do not end with the performance of his duties. Every workman in these industries, from the corporation official to the ordinary laborer, is being well paid for his services and can well afford to invest liberally in the $2,000,000,000 (£410,000,000) Liberty Loan with which the Government is to meet the immediate expenses of our share in the war. The terms of investment place this opportunity for patriotic service within the reach of all. Practice economy and invest your savings in Liberty Bonds!

Stop the Confusion and Delay, and Build Ships

FROM the moment, two months ago, when the United States went to war with Germany, the call from our allies has been loud and insistent for ships and more ships. No other nation in the world can supply vessels in sufficient numbers and tonnage to carry the food, men and munitions which must be supplied to Europe—not a year hence, but during the coming twelve months. Can any duty of the United States be more plain, more imperative or more vital than this?

And yet two months have gone by with little but confusion, disconcerted action, misdirected efforts expended at cross purposes and vague promises as a result. Two months ago MARINE ENGINEERING had letters from no less than fifty builders of wooden vessels, who either had wooden cargo ships under construction, which they were ready to place at the disposal of the government, or could provide ways for building new ships. Since then not one of these yards has received a government contract or order for ships.

During the past twelve months, Great Britain and other foreign countries have placed orders with American shipbuilders for over 200 sea-going cargo vessels of over 1,000,000 gross tons. These orders have been promptly accepted by the builders, and in spite of the fact that existing shipbuilding facilities in the United States were crowded with work, means have been provided and satisfactory progress has been made in the construction of these ships. Is there any reason to doubt that the great need for a large volume of new tonnage will not be promptly and satisfactorily met?

Major-General Goethals, general manager of the United States Shipping Board Emergency Fleet Corporation, has been pledged the support of the steel makers for materials for the construction of 3,000,000 tons of steel ships within eighteen months. It is a foregone conclusion that the necessary funds, amounting to $750,000,000, will be provided by Congress, and there should be no further delay in putting this gigantic shipbuilding programme into action. At the same time, the plans already developed for building a large fleet of wooden cargo vessels should be pushed forward with the utmost speed. In this crisis, wooden ships will be of as great value as steel ships, and every ton of shipping that can possibly be produced must be built.

This is the time for action—not disputes and delays. Build the ships!

What the Shipping Board Has Done

UP to May 21 the following contracts have been let by the United States Shipping Board Emergency Fleet Corporation: Merrill-Stevens Company, Jacksonville, Fla., 12 wooden and 4 steel vessels; Los Angeles Shipbuilding & Dry Dock Company, Los Angeles, Cal., 8 steel vessels; G. M. Standifer Construction Corporation, Portland, Ore., 10 wooden vessels; Peninsula Shipbuilding Company, Portland, Ore., 4 wooden vessels. Since that date contracts for 24 additional wooden ships and 6 steel barges have been let, making 68 ships in all.

To expedite the work of construction the Emergency Fleet Corporation has divided the entire coast of the country into eight separate districts, and for each district an inspector has been appointed who has authority to act for the corporation in that district. The districts and inspectors are as follows:

Maine to eastern Massachusetts, inclusive, W. H. Hand, Jr., New Bedford, Mass.; east Massachusetts to Delaware River, New Jersey, Eads Johnson, 115 Broadway, New York; Chesapeake and Delaware and the Atlantic Coast from Philadelphia to Norfolk, C. R. McDermott, Munsey Building, Washington, D. C.; Virginia to Florida (Atlantic and Gulf Coasts), W. V. McGowan, United States Engineer Office, Jacksonville, Fla.; east of Mississippi River to Georgia, Warren Johnson, New Orleans, La.; Texas and the Mississippi River, Charles N. Crowell, Merryville, La.; Pacific Coast, Captain A. F. Pillsbury, 310 Sansome street, San Francisco, Cal., and under Captain Pillsbury, for Puget Sound district, John S. Blain, Securities Building, Seattle, Wash.

Standard Type Wooden Cargo Steamer for United States Emergency Fleet

PLANS and specifications for the standard type wooden cargo steamship to be built by the United States Shipping Board Emergency Fleet Corporation have been prepared by Theodore E. Ferris, naval architect, 30 Church street, New York. The plans provide for a vessel 281 feet 6 inches long over all, 268 feet long between perpendiculars, 46 feet beam over the planking, 45 feet 2 inches beam

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molded, 26 feet depth molded and 23 feet 6 inches load draft. The deadweight carrying capacity will be about 3,000 tons. About 1,500,000 feet of lumber, board measure, will be required for each vessel.

Propulsion will be by steam or internal combustion engines of 1,400 horsepower, driving single or twin screws. Owing to the large number of vessels to be built it will obviously be impossible to use a standard type of machinery in all the vessels. The type which is given preference is a single-screw arrangement with triple expansion engines supplied with steam from oil- or coal-fired watertube boilers operating under forced draft. While the majority of the vessels will be powered with steam engines either of the reciprocating type or geared turbines, some of the boats will probably be equipped with heavy oil engines.

In all of the vessels steam is to be furnished at 190 pounds per square inch from either two three-furnace, single-ended Scotch boilers, 14 feet 6 inches inside diameter by 11 feet 2 inches long, having a total heating surface of 4,500 square feet and a grate area of 105 square feet, or by watertube boilers of approved type having a total heating surface of 5,000 square feet.

For single screw vessels, equipped with reciprocating engines, the engine cylinders are to be 19 inches, 32¼ inches and 54 inches diameter by 42 inches stroke, designed to develop 1,400 indicated horsepower at 90 revolutions per minute with a piston speed of 630 feet per minute. In this installation a single surface condenser of 2,500 square feet of cooling surface is to be installed.

In twin screw vessels fitted with reciprocating engines, the engine cylinders are to be 14¾ inches, 25 inches and 42 inches diameter by 27 inches stroke designed to develop 700 indicated horsepower at 115 revolutions per minute, and 900 indicated horsepower at 133 revolutions per minute, with a piston speed not over 600 feet per minute. In the twin screw arrangement, two separate condensers are to be installed, each of 1,300 square feet cooling surface.

In turbine-driven vessels, propulsion is to be by one double reduction geared turbine developing 1,400 shaft horsepower, with the propeller turning at 110 revolutions per minute. With steam at 180 pounds per square inch pressure at the throttle and a 28-inch vacuum, the steam consumption is not to exceed 12.5 pounds per shaft horsepower hour. Reversing turbines are to be incorporated with the ahead turbine designed to develop two-thirds of the full power of the ahead turbine.

The machinery and crew's quarters are located amidships, while forecastle and poop decks are also provided. Each vessel will have accommodations for a crew of 30 men with additional accommodations for 12 gunners, as each vessel will be armed with guns fore and aft. Each vessel will have four cargo hatches, two masts and eight cargo booms. The vessels will be lighted with electricity and fully equipped with wireless and other standard equipment.

The hull construction is of conventional single-deck type with open holds and 'tween deck beams. The frames are double 12-inch by 12-inch, molded 18 inches at the keel and tapering to 10 inches at the deck, spaced 36 inches. Alternate designs for the frames have been provided—one for yellow pine and the other for Douglas fir.

The keel is 16 inches sided by 14 inches molded and is fitted with an oak shoe 3 inches by 16 inches. The garboard strakes are of yellow pine, 10 inches by 14 inches, 8 inches by 14 inches and 6 inches by 14 inches, respectively. The bottom planking is 5 inches by 14 inches; around the bilge it is 6 inches by 10 inches, and the side planking is 5 inches by 10 inches. The upper strakes are 5 inches by 8 inches and the topsides 6 inches by 9 inches, all of yellow pine. The ceiling, also of yellow pine, is 10 inches by 12 inches, increased at the bilge to 14 inches by 14 inches.

The main keelson is made up of six timbers 14 inches by 14 inches with two side keelsons, 14 inches by 14 inches. Wing girder keelsons, 10 inches by 14 inches, are also fitted, in addition to the main keelson. The hull is further stiffened by a double row of stanchions throughout the holds with additional stanchions at the corners of the hatches.

Strengthening of the hull against torsional strains is provided by iron strapping fitted between the outside of the frames and the inside of the planking. This strapping consists of a top chord at the upper deck beams, 8 inches by ¾ inch, extending from 12 feet forward of the forward hatch to 12 feet aft of the after hatch. The plates in this chord are connected by triple riveted butt straps and are fastened to each frame by two 1-inch by 8-inch bolts staggered. Diagonal straps of 4-inch by ½-inch iron let into the outside of the frames and inclined at 45 degrees each way will be fitted so as to meet at the top chord in every other frame space. The diagonals will be connected to the chord by two ⅞-inch rivets and at each crossing by one 1-inch rivet. They are also fastened to each frame timber by one 1-inch by 8-inch bolt. The diagonals are to be carried well down and wrapped around the bilge far enough to overlap the ends of the floor timbers.

Contracts for the construction of these vessels will be made, it is understood, on a lump-sum basis only. The first payment will be made within thirty days after the signing of the contract, and further payments of 5 percent each of the total contract price will be made within sixty and ninety days respectively after the signing of the contract. The following percentages of the contract price of each vessel in the contract will be paid: 20 percent when the keel is laid, 30 percent when completely framed, 15 percent when launched, 10 percent when the machinery is installed, and the balance thirty days after the vessel is delivered and accepted.

Two and One-Quarter Million Tons of Merchant Shipping Building in the U. S.

A thorough canvass of the principal shipyards in the United States, made by MARINE ENGINEERING on May 1, shows that 2,250,000 tons of merchant ships are now under construction, 52.5 percent being built on the Atlantic and Gulf coasts, 33.2 percent on the Pacific coast and 14.3 percent on the Great Lakes.

The report comprises returns from 96 shipyards. In all, 723 merchant vessels of 2,248,200 gross tons are under construction. Three hundred and nineteen of these vessels, aggregating 1,539,354 gross tons, are freight steamships or motorships, 77 vessels of 365,488 gross tons are tankers, 10 vessels of 55,260 gross tons are passenger and freight steamers, and 118 vessels of 159,663 gross tons are wooden ships, either schooners or auxiliary schooners, while the remainder, or 199 vessels of 128,435 gross tons, are miscellaneous craft, such as barges, lighters, car floats, ferryboats, etc.

The output of the various shipyards is shown in Tables I-V. A complete list of all the vessels under construction, showing the hull number, type of vessel, gross tonnage, builders and owners, is issued in printed form (price, 10 cents) and can be obtained by sending directly to the office of MARINE ENGINEERING.

The largest shipbuilding centers in the United States are the Delaware district (including New Jersey and New York) on the Atlantic Coast, and the Puget Sound district

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TABLE I.—FREIGHT STEAMSHIPS AND MOTORSHIPS

	Number	Gross Tonnage
Albina Machine Works, Portland, Ore.	6	21,800
American Shipbuilding Co., Cleveland, O.	54	142,600
Ames Shipbuilding & Drydock Co., Seattle, Wash.	12	105,600
Baltimore Dry Docks & Shipbuilding Co., Baltimore, Md.	4	16,480
Bethlehem Steel Co. (Maryland Shipbuilding Plant), Sparrows Point, Md.	10	61,184
Chester Shipbuilding Co., Ltd., Chester, Pa.	8	43,600
Clooney Construction & Towing Co., Westlake, La.	1	1,200
Columbia Shipbuilding Corporation, Portland, Ore.	9	51,570
Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.	4	26,160
M. M. Davis & Son, Solomons, Md.	1	1,000
J. F. Duthie & Co., Seattle, Wash.	7	40,110
W. & A. Fletcher Co., Hoboken, N. J.	3	.....
Fore River Shipbuilding Corp., Quincy, Mass.	7	51,900
Great Lakes Engineering Works, Detroit, Mich.	29	116,200
Harlan & Hollingsworth Corporation, Wilmington, Del.	7	19,339
Manitowoc Shipbuilding & Dry Dock Co., Manitowoc, Wis.	9	20,750
Mathews Shipbuilding Co., Hoquiam, Wash.	4	5,800
Merrill-Stevens Co., Jacksonville, Fla.	1	1,700
Moore & Scott Iron Works, San Francisco, Cal.	7	63,500
Samuel L. Moore & Sons Corp., Elizabeth, N. J.	2	5,230
Newport News Shipbuilding & Dry Dock Co., Newport News, Va.	6	35,800
New York Shipbuilding Corp., Camden, N. J.	16	115,200
Pacific-American Fisheries, So. Billingham, Wash.	6	12,300
Pennsylvania Shipbuilding Co., Philadelphia, Pa.	8	62,800
Pusey & Jones Co., Wilmington, Del.	7	28,000
Seaborn Shipbuilding Co., Tacoma, Wash.	1	1,000
Seattle Construction & Dry Dock Co., Seattle, Wash.	9	53,900
Skinner & Eddy Shipbuilding Corp., Seattle, Wash.	10	57,120
I. L. Snow & Co., Rockland, Me.	1	1,600
Standard Shipbuilding Co., New York	9	65,700
Staten Island Shipbuilding Co., West New Brighton, N. Y.	8	16,000
St. Helens Shipbuilding Co., St. Helens, Ore.	2	1,950
Sun Shipbuilding Co., Philadelphia, Pa.	8	53,200
Tampa Shipbuilding & Engineering Co., Tampa, Fla.	2	7,000
Texas Co. (Bath Yard), New York	2	12,000
Toledo Shipbuilding Co., Toledo, O.	12	31,100
Union Iron Works Co., San Francisco, Cal.	18	117,320
Willamette Iron Works & Northwest Steel Co., Portland, Ore.	8	70,000
Winslow Marine Railway & Shipbuilding Co., Winslow, Wash.	1	1,250
Total	319	1,539,354

TABLE II.—TANKERS

	Number	Gross Tonnage
American Shipbuilding Co., Cleveland, O.	1	5,200
Baltimore Dry Docks & Shipbuilding Co., Baltimore, Md.	5	16,250
Bethlehem Steel Co. (Maryland Shipbuilding Plant), Sparrows Point, Md.	2	18,400
Chester Shipbuilding Co., Ltd., Chester, Pa.	7	38,500
Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.	2	14,200
W. & A. Fletcher Co., Hoboken, N. J.	3	.....
Fore River Shipbuilding Corp., Quincy, Mass.	4	26,712
Great Lakes Engineering Works, Detroit, Mich.	1	2,200
Harlan & Hollingsworth Corp., Wilmington, Del.	4	25,305
Merrill-Stevens Co., Jacksonville, Fla.	3	1,600
Moore & Scott Iron Works, San Francisco, Cal.	1	10,000
Newport News Shipbuilding & Dry Dock Co., Newport News, Va.	5	43,673
New York Shipbuilding Corp, Camden, N. J.	7	53,688
Pennsylvania Shipbuilding Co., Philadelphia, Pa.	6	30,000
Riter-Conley Manufacturing Co. (Baltimore Yard), Pittsburg, Pa.	2	3,000
Skinner & Eddy Shipbuilding Corp., Seattle, Wash.	3	19,800
Sun Shipbuilding Co., Philadelphia, Pa.	2	14,200
Tank Ship Building Corp., Newburgh, N. Y.	6	12,000
Texas Co. (Bath Yard), New York	2	12,000
Union Iron Works Co., San Francisco, Cal.	11	18,760
Total	77	365,488

TABLE III.—PASSENGER AND FREIGHT STEAMERS

	Number	Gross Tonnage
Wm. Cramp & Sons' Ship & Engine Building Co., Philadelphia, Pa.	5	33,400
Harlan & Hollingsworth Corp., Wilmington, Del.	2	13,400
New York Shipbuilding Corp., Camden, N. J.	2	8,000
James Rees & Sons Co., Pittsburgh, Pa.	1	460
Total	10	55,260

on the Pacific Coast. In the Delaware district there are building 254 vessels of 731,316 gross tons. In the Puget Sound district there are building 116 vessels of 522,320 gross tons.

The next largest district is the Great Lakes, where 118 vessels of 321,241 gross tons are under construction. This is closely followed by the Chesapeake Bay district, where 73 vessels of 228,626 gross tons are under construction.

TABLE IV.—WOODEN VESSELS: SCHOONERS AND AUXILIARY SCHOONERS

	Number	Gross Tonnage
Atlantic Coast Co., Thomaston, Me.	3	4,800
G. S. Baxter & Co., Jacksonville, Fla.	3	3,300
Bean Shipbuilding Co., Camden, Me.	3	3,600
Benicia Shipyards Co., Benicia, Cal.	2	2,500
F. S. Bowker & Sons, Phippsburg, Me.	2	1,250
Brunswick Marine Construction Corp., Brunswick, Ga.	5	9,550
Brunswick Shipbuilding Co., Brunswick, Ga.	1	750
Clooney Construction & Towing Co., Westlake, La.	7	4,756
Francis Cobb Co., Rockland, Me.	3	2,747
Columbia Engineering Works, Portland, Ore.	1	300
G. G. Deering Co., Bath, Me.	1	1,400
Chas. E. Fulton, San Pedro, Cal.	2	3,600
Georgia Shipbuilding Co., Savannah, Ga.	2	1,720
Geo. A. Gilchrist, Thomaston, Me.	1	1,200
Gray's Harbor Shipbuilding Co., Aberdeen, Wash.	6	14,400
Richard T. Green Co., Chelsea, Mass.	1	1,300
Hanlon Dry Dock & Shipbuilding Co., Oakland, Cal.	1	3,500
Hillyer-Spearing-Dunn Co., Jacksonville, Fla.	1	780
Howland & Nelson, Beaumont, Tex.	2	2,000
Kruse & Banks, Northbend, Ore.	5	7,000
McEachern Ship Co., Astoria, Ore.	7	12,200
Palmer Shipbuilding Co., Noank, Conn.	4	10,000
Peninsula Shipbuilding Co., Portland, Ore.	4	6,400
Percy & Small, Bath, Me.	3	3,825
Henry Piaggio, Orange, Tex.	5	10,400
Puget Sound Bridge & Dredging Co., Seattle, Wash.	3	7,500
Read Brothers Co., Fall River, Mass.	2	2,200
Savannah Engineering & Construction Co., Savannah, Ga.	3	3,750
Sawyer Bros., Millbridge, Me.	1	600
Schultze Shipyard, San Francisco, Cal.	1	200
Seaborn Shipbuilding Co., Tacoma, Wash.	3	5,700
Sharpstown Marine Railways Co., Sharpstown, Md.	1	1,100
Slidell Shipbuilding Co., Slidell, La.	4	4,600
Standifer-Clarkson Shipbuilding Co., No. Portland, Ore.	2	2,950
St. Helens Shipbuilding Co., St. Helens, Ore.	2	3,270
W. F. Stone Shipyard, Oakland, Cal.	5	4,350
Arthur D. Storey, Essex, Mass.	5	1,165
Townsend Marine Railway & Construction Co., Boothbay Harbor, Me.	3	3,400
E. J. Tull, Pocomoke City, Md.	2	1,600
Washington Shipping Corporation, Seattle, Wash.	4	10,000
Wilmington Iron Works, Wilmington, N. C.	2	4,000
Total	118	159,663

TABLE V.—MISCELLANEOUS CRAFT: BARGES, LIGHTERS, CAR FLOATS, ETC.

	Number	Gross Tonnage
American Bridge Co., Pittsburg, Pa.	93	44,942
American Car & Foundry Co. (Jackton & Sharp Plant), Wilmington, Del.	5	3,071
American Shipbuilding Co., Cleveland, O.	2	700
Wm. H. Baldwin, New Baltimore, N. Y.	2	199
Baltimore Dry Dock & Shipbuilding Co., Baltimore, Md.	1	145
Bath Iron Works, Bath, Me.	1	650
Clooney Construction & Towing Co., Westlake, La.	11	10,500
Coastwise Shipping Co., Baltimore, Md.	11	10,500
Cowles Shipyard Co., Buffalo, N. Y.	2	135
M. M. Davis & Son, Solomons, Md.	7	10,500
Dubuque Boat & Boiler Works, Dubuque, Ia.	2	1,415
W. & A. Fletcher Co., Hoboken, N. J.	13	.....
Great Lakes Towing Co., Cleveland, O	2	142
Hillyer-Spearing-Dunn Co., Jacksonville, Fla.	2	4,800
Kelly-Spear Co., Bath, Me.	3	5,212
B. P. Lanteri, Pittsburg, Cal.	2	.....
Manitowoc Shipbuilding & Dry Dock Co., Manitowoc, Wis.	2	600
McAteer Shipbuilding Co., Seattle, Wash.	1	20,000
Mathis Yacht Building Co., Camden, N. J.	7	.....
New York Shipbuilding Corp., Camden, N. J.	2	1,530
Pusey & Jones Co., Wilmington, Del.	5	3,100
James Rees & Sons Co., Pittsburg, Pa.	2	300
Rohde & Sons Co. Shipyard, Baltimore, Md.	5	2,950
Southern Transportation Co., Chesapeake City, Md.	2	2,000
Spedden Shipbuilding Co., Baltimore, Md.	5	1,644
Texas Co., Bath, Me.	2	.....
E. J. Tull, Pocomoke City, Md.	4	2,400
Union Iron Works Co., San Francisco, Cal.	3	1,000
Total	199	128,435

In the Southern district, which includes the Gulf Coast, there are 55 vessels of 72,406 gross tons under construction, while on the New England coast there are 54 vessels of 147,561 gross tons building.

Outside of the Puget Sound district, on the Pacific Coast, the output of the shipyards comprises 53 vessels of 224,730 gross tons.

It is interesting to note that nearly 75 percent of the tonnage building on the Great Lakes is suitable for ocean-going service, while over 90 percent of the tonnage building on the sea coast is suitable for the deep sea carrying trade.

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Inter-Imperial Ship Lines Proposed for Great Britain

The report of the British Commission recommends the establishment of a permanent Imperial Development Board to carry out plans of co-ordination between the parts of the Empire for economic growth after the war. Among the developments that it strongly advocates is that of inter-Imperial communications in freight transportation, speedy mail and passenger service, and Imperial control of cable and telegraph systems. The Commission gathered much information about the practicalities of the subject that is very interesting.

Particularly interesting is the picture of future shipping and mail routes linking up widely separated parts of the British Empire and furnishing the trunk lines from which Empire trade to other countries may branch off. The Commission studied with experts in ship construction the economies of building big ships, and to make the use of big ships practical on routes best suited to connect the ports of the Empire, it calls attention to its belief that one of the first duties of the permanent Imperial Development Board will be to begin a comprehensive scheme of improvement of the harbors of England and the dependencies, so that the big ships may be accommodated at ports of call on routes mapped out. The Commission says:

"Both cheapness of transport and high speed are unobtainable except in vessels of great length and proportionate draft. Under present conditions such vessels are impractical, as the harbors and the waterways of the Empire will not admit them.

"To some extent these considerations have influenced the minds of shipowners, naval architects, and harbor authorities, but the improvement of isolated harbors is of little avail unless all the harbors on a given route are brought up approximately to the same level. Joint co-ordinated action is required. Individual disconnected improvement is of little use. It is, therefore, obvious that efforts should be made to correlate and develop the existing and future capacity of harbors on the great trade routes of the Empire."

The advantage to the United States of having its river and harbor improvements under the charge of Federal authority is recognized and the analogous advantage of an Imperial authority pointed out. The Commission finds that the most important harbors both on the Atlantic and Pacific coasts of this country and the Panama Canal have already been correlated in the way they recommend for the long trade routes around the world.

What is said about economic size of ships for this purpose is of value:

"Taking 28 feet 3 inches as the economic draft for a vessel 490 feet in length, it was found that this draft increased to 30 feet for a vessel 520 feet in length, to 33 feet for one 573 feet in length, to 34 feet for one 590 feet in length, and to 38 feet for one 660 feet, and so on."

The mechanical reasons for these economies are quoted from the British shipbuilding authority, Sir J. H. Biles, who says:

"The conclusion that unrestricted draft is necessary for economic transport can be arrived at from first principles. A vessel constructed of a depth sufficient to go to, say, 40 feet draft does not cost so very much more than a vessel of a depth constructed to go to 29 feet draft, whereas the increase in weight of cargo is the difference between the extreme draft of the vessel and the draft the vessel must have in order to float her hull, and machinery, and coal, and stores.

"Supposing two ships are constructed, the one of 29 feet draft and the other of 40, and in each case the draft necessary to float hull, machinery, etc., before paying cargo can be put in, is 23 feet. In the one case there is only 6 feet of draft available for paying cargo, whereas in the other case there is 17 feet. The weight of hull for the restricted draft vessel increases much more rapidly than the displacement. The beam cannot be increased in the same ratio as the length, or the stability conditions will be interfered with. Before a great length is reached the deadweight that can be carried no longer increases as the length of vessel increases, but begins to decrease. Further, the excessive proportion of breadth to draft in the large vessel of restricted draft is bad from the point of view of resistance and therefore the running costs, which depend on the power of the machinery, are considerably increased."

Following out this principle, Sir John Biles supplied various practical and very striking illustrations. He found that if draft were unrestricted the cost of transport steadily decreased with increase of length: thus a vessel 700 feet long, with proportionate draft, could transport goods on a 3,000-mile voyage at a speed of 14 knots 13 percent cheaper than a smaller vessel of 490 feet in length, while further increase in speed in the larger vessel would be less costly. He also found that increase in length is uneconomical unless accompanied by adequate draft; thus, with draft restricted to 23 feet 3 inches, the cost of transport per ton for a voyage of 3,000 miles by a vessel 700 feet in length would be 50 percent greater than if the same vessel had its full proportionate draft; in fact, increase of length without proportionate increase of draft not only does not diminish cost of transport, but actually increases it.

The Commission suggests that these proportions might be considerably modified through improvements in motive power, presumably through application of oil engines to big ships.

Largest American Marine Diesel Engine Installation Proves Successful

The largest Diesel engined motorship so far built in the United States is the twin-screw naval collier *Maumee*, of 14,500 tons displacement, propelled by two single-acting, two-cycle Diesel engines of 2,600 shaft horsepower each. The engines were built by the machinery division of the New York Navy Yard, Brooklyn, N. Y., in accordance with original designs secured from the Machinen Fabrik Augsberg, Nurnberg, Germany, through the New London Ship & Engine Company, Groton, Conn. Each set of engines has six cylinders with a diameter of 25.2 inches and a stroke of 37.37 inches. At a normal speed of 130 revolutions per minute the engines are designed to give the ship a speed of 14 knots.

Since the *Maumee* was completed last December the vessel has been in active service for five months, and during that time has made 18,000 miles without a hitch. The engines have proved very satisfactory in service, and have been ready to respond to any emergency. The only defect that has developed has been the cracking of some of the cylinder jackets, which is apparently due to lack of sufficient clearance between working liners and jackets. It is thought that additional clearance can readily be allowed and that when this is done the engines will be ready for any service.

The fuel economy is excellent, the consumption being less than one-half that required for the most economical steam plants. Ordinary Navy fuel oil is used. The con-

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sumption is about .5 pound of oil per shaft horsepower for all purposes.

The engines handle very well, and as the *Maumee* is a vessel engaged in service that requires repeated going alongside of vessels, docks, etc., the handling requirements are particularly severe.

The overhaul and upkeep requirements have been very meager, and but for the cracked castings have been attended to for five months' continuous running by the ship's facilities. The cost of the upkeep is apparently considerably less than for a steam plant of the same power and similar service. Less operating personnel is also required.

The weight of the installation is about the same as for a triple-expansion reciprocating steam plant, but, owing to the fuel economy, about 7 percent additional cargo-carrying capacity is available.

The actual performance of the *Maumee's* engines has demonstrated that large Diesel engines present fewer difficulties in service than do small or medium installations, and there are no apparent reasons why the power per cylinder on the *Maumee* (about 500 horsepower) should not be doubled with entire success. This indicates that Diesel engines of 5,000 horsepower per engine are an entirely feasible proposition.

For cargo boats operating in localities where fuel oil is available, the Diesel engine admittedly has great advantages. The extra first cost can very likely be made up in the first year's operation. Certain special advantages of the Diesel installation may be mentioned, as follows:

(a) The engine is ready to move in a few minutes.

(b) Full power either ahead or backing is available any time.

(c) No smoke or cinders, hence extreme cleanliness can easily be maintained (a particular advantage for passenger ships).

(d) Regulation of speed is much easier and certain.

(e) All stand-by losses are eliminated. Fuel consumption begins and ceases with the movement of the engines.

Orders to Shipping Designed to Increase Safety of Life and Vessels in War Zones

Orders have been issued, effective May 12, by the Board of Supervising Inspectors, Steamboat Inspection Service of the Department of Commerce, by Gen. George Uhler, Supervising Inspector General, and approved by Secretary Redfield, providing for an increase in life saving and safety appliances and equipment to be carried by all vessels entering the war zone. These orders were prepared at the direction of Secretary Redfield, who had ascertained that of all the Americans who had lost their lives in the war zone only two have been killed by gunfire or like violent means.

According to these orders to the supervising inspectors of all districts, the capacity of lifeboats shall hereafter be 15 cubic feet for each person instead of 10 feet, as heretofore. This reduces the carrying capacity about one-third, allows more room and ample room for rowing operations.

Summary of New Orders

In addition to the equipment of lifeboats required by existing regulations, there shall be provided a hand pump for each boat with a plunger of not less than two inches in diameter and a discharge pipe of sufficient length to reach clear of the boat's side. This to render more effective the bailing of lifeboats. The food or provisions required to be carried in the lifeboats may be hard bread or the United States "emergency ration" in tins. Each ration is sufficient to maintain a grown man twenty-four hours. Food which produces unusual or immediate thirst, such as corned beef, salt fish and the like, will not under any circumstances be allowed. When hard bread is carried, there must be provided in addition at least ten tins of the emergency ration.

Lifeboats on cargo steamers shall be provided with a separate set of davits for each lifeboat. Additional davits to be installed must be of the mechanical type, to facilitate quick and safe launching. The old type of davits with "turning-out gear" are not classed as mechanical davits.

Lifeboats Required

Cargo vessels shall carry sufficient lifeboats based on the reduced capacity stated to accommodate every person on board and in addition shall carry a sufficient number of approved life rafts to accommodate at least 25 percent of the total number of persons on board.

Before entering the war zone all lifeboats and life rafts shall be cleared away and made ready for launching, and the master or officer in charge shall assure himself that all the required equipment is in the lifeboats and life rafts, in good order, and ready for immediate service. Steamers which are not equipped with mechanical davits shall have all lifeboats swung out (weather permitting) and ready for immediate launching before entering the war zone. Cargo vessels contracted for after May 1, 1917, and serving trades within the war zone, shall be equipped on each side with lifeboats of sufficient capacity to accommodate all persons on board, based on an allowance of 15 cubic feet per person, and in addition thereto shall be equipped with a sufficient number of approved life rafts to accommodate at least 25 percent of all persons on board.

Launching of Lifeboats

The board also suggests that as many, or nearly all, lives that have been lost from vessels after attack have been due in many instances to the fact that the boats have been launched while the ship had considerable way, either ahead or astern, and engineers have been compelled to abandon the engine room while the engines were still working, the bridge watch or master assure themselves, if possible, that the engines are at rest and the way off the vessel before the boats are launched.

It is also strongly recommended that, due to the possibility of boats on the weather side of the ship not being available, that the full lifeboat capacity on cargo ships be carried on each side, so that the full capacity may be available at all times.

Day and Night Watch

It is also strongly recommended that on all vessels entering the war zone or dangerous areas the passengers and crew be kept fully prepared day and night, so far as possible, for speedy and immediate disembarking or abandoning ship in case of an emergency, and that the crew be furnished with life preservers of such character as to allow the free use of the arms in rowing and boat launching. All should be warmly clad without unnecessary or hindering incumbrance.

The requirements and suggestions are asked to be met promptly and generously, and it is expected that all concerned will co-operate in making better and safer conditions in the navigation of dangerous areas. Local inspectors are told, however, not to unnecessarily delay vessels proceeding on their way to ports of the Allies if it is not possible to meet all these requirements previous to the appointed time of departure.

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LETTERS TO THE EDITOR

Conversion of Sailing Vessels Into Power-Propelled Ships for Emergency Cargo Fleet

In the face of the most urgent necessity for power-propelled ships, it seems surprising that the responsible authorities entirely overlook the possibilities that can in short order be obtained from converting our large coastwise sail schooner fleet into steam- or motor-propelled craft. With a twin-screw arrangement the principal structural members of the sailship would remain intact, while the necessary structural alterations could readily be made in a thoroughly substantial and durable manner with very little loss of time.

For power plants the engines and boilers of the large tugboat fleets could readily be removed and quickly installed in the converted sailships.

This tugboat machinery ranges usually from 300 to 800 indicated horsepower and would in the twin arrangement furnish quite suitable power to ships from 180 to 240 feet long, enabling them to make from 9 to 12 knots speed. All cargo ships, of course, will have to be specially protected against U-boat attacks either by arming them or by providing naval convoys.

New York. THEODORE LUCAS.

Reliability of Large Diesel Engine-Driven Vessels Shown by Performance of Motorship Sebastian

The Diesel-driven motorship *Sebastian* (7,200 tons displacement) was placed in service at the end of last June, since when she has covered approximately 40,000 nautical miles at an average speed of almost 9 knots, without a single breakdown, cylinder crack, or piston crack, cylinder-head crack, crankshaft fracture, etc., although she has been worked in the heaviest of Atlantic winter weathers.

The total number of engine stops at sea (accessory adjustments only) in nearly ten months amount to four hours with one engine and five hours with the other engine, also six hours with one engine when salt water got into the lubricating oil and had to be cleaned out. The mileage covered would have been about 3,000 miles greater had she not been held up in England for fifteen days having certain alterations to her deck structure previous to her last recent voyage to New York.

Fuel consumption of the two main engines together has averaged under 6 tons (42 barrels) for 24 hours, with the engines averaging a fraction under 1,000 indicated horsepower *each* at 115 revolutions per minute. This figures out at 0.27 pound per indicated horsepower hour, or just over 0.4 pound per shaft horsepower. In her holds she carries 4,100 tons of cargo.

On the last voyage to an American port both her Diesel engines ran for sixteen days and nights without a single stop, voluntarily or otherwise, averaging 8.8 knots in most heavy seas and adverse winds.

In nearly ten months the main bearings have worn down 1/128th part of an inch. The crankpin bearings, although opened out for examination at regular periods, have only been readjusted once in ten months, the wear showing 0.2 millimeter. The crosshead bearings have been readjusted to 0.3 millimeter in the same period. Compressor piston rings are the same which came out with the ship, and show hardly any wear at all. A few of the main piston rings have been renewed, but this has been mostly due to breaking them when springing them off the pistons for cleaning purposes. The cooling pump valves are as good as the day they were put in, some ten months ago.

Furthermore, the Diesel engines, which were built by Werkspoor of Amsterdam, were not run or tested in the shops. They were built, sent to England in packing cases, and installed in the *Sebastian*, which was given a few hours' sea trial, and sent on her maiden voyage, arriving in New York in sixteen days.

The owners of the vessel are Lane & Macandrew, of London. All the engineers of this ship state that their work at sea is far less arduous than that aboard a steamer and that they have little to do other than watch the lubricating oil.

Diesel engines have enormous reserve emergency power, which can instantly be developed by increasing the pressure of the injection-air, and the chief engineer of the *Sebastian* considers that if chased by a submarine he could obtain for a few hours as much as 1,500 indicated horsepower per engine, although the builders' rating is 1,100 indicated horsepower at 130 revolutions per minute. Although passing through the war zone a motorship is nearly immune from submarine attacks because of the absence of smoke from her funnel, so that three miles away she is not visible to the periscope of a submarine in average weather, whereas the smoke of a steamer gives the U-boat about twenty miles' radius.

T. ORCHARD LISLE.

Diagonal Strapping in Large Wooden Ships

I have been exceedingly interested in reading Mr. William T. Donnelly's article on the "Problem of the Wooden Cargo Ship," published on page 206 of the May number. Because Mr. Donnelly invites criticism, I am sending you a copy of a letter which I have just been writing to the United States Shipping Board.

Mr. Donnelly has the right idea as to the proper distribution of material in the upper and lower members, or "booms," of the girder or truss which is the ship itself. His longitudinal bulkhead, if retained in his design, might be modified to advantage; shearing strains are best met by diagonal members. It is very important that a wooden ship should have transverse bulkheads, to prevent "racking" strains from changing the transverse shape of the ship, and if the character of the cargo (long sticks of timber, for example) make transverse bulkheads objectionable, then partial transverse bulkheads must be made use of, to secure the necessary strength.

Mr. Donnelly's bilges are not new, but they have appealed to me as the most unobjectionable way of getting round one difficulty at that place. If he will modify his design by incorporating diagonal planking, either inside or outside, I believe he will have a most excellent, strong and durable ship, so far as wear and tear go. You cannot build a durable ship out of green, unseasoned material, and he, in common with all those in any way connected with rush-order wooden ships, is going to suffer. I believe in steel for ships—not wood—under normal conditions, but if we are going to have wooden ships they should be built as intelligently as possible.

LETTER TO THE UNITED STATES SHIPPING BOARD

"Conceive a series of planks well put together to represent the longitudinal fastening of a ship, and another series laid across them to represent the transverse framing, with every plank fastened to every crossbeam by a through-bolt or nail; and then conceive every joint of these planks to be filled with hard stuff, like oakum, hammered into it with an iron wedge and mallet until the joint is hammered

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quite hard and can hold no more, and the structure seems quite rigid—as rigid as we can conceive it, and for the moment it is as rigid as we do conceive it; but unluckily it will not stand so.

"Subject this structure to light strains it will remain riged, but subject it to such a strain as will slightly compress the longitudinal plank, and do this cornerwise alternately in opposite directions, and you will find that as you change the direction of the strain from one corner to the other askew each plank will move a little way along the other and return back again when the force is the other way. This goes on more and more as you repeat the operation, and this is exactly what does happen to the planks of a ship when she labors long and heavily over a head-sea. Likewise it is what does happen to the frame when she labors heavily in a cross-sea.

"To those heavy strains everything is found to yield a little; planks give by each moving a little along the other, bolts begin to widen their holes as the planks strain across them, first one way, then the other; the couples of the timbers begin to draw from their fastenings as the ship careens first on one side, then on the other. A friend of mine who made a voyage across the Atlantic in heavy weather in a very large wooden ship of weak construction used to watch carefully the edges of the planks opening and shutting as she went from the top to the hollow of a sea, and used to fill his tumbler by watching the opportunity when a joint near him opened and a jet of water passed in. I saw her when she returned from the voyage, and I was satisfied that the seams must have opened wide, for I saw the oakum calking hanging in festoons. She went another voyage and was never heard of again."

The foregoing was written by a famous naval architect, a vice-president of the Institution of Civil Engineers and also a vice-president of the Institution of Naval Architects, in the year 1865, when wooden shipbuilding was a highly developed art—now unfortunately a lost art. Sir Robert Seppings is usually credited with being the first to point out the necessity of providing diagonal strength, and back in the '50's of the last century the largest and best wooden ships were always built with "Seppings' diagonals," either in the shape of diagonally disposed timbers, wrought iron straps passing from wales to keel or diagonal planking combined with the longitudinal planking.

As early as 1847, when the keel of the *Powhatan* was laid at the Norfolk Navy Yard, the United States Navy Department was specifying for such vessels (she was 251 feet 6 inches long by 45 feet beam by 26 feet 6 inches deep) diagonal strapping, and every officer familiar with the history of our navy knows what a long and useful life this particular wooden-hull vessel enjoyed.

In 1849 Messrs. Bishop & Simonson built the *Ohio* (248 feet by 45½ feet by 24½ feet) for the Law Line and Smith & Dimon built the *Georgia* (255 feet by 49 feet by 25½ feet) for the same company. Both ships were diagonally braced with 3-inch round iron. The Collins Line steamers *Atlantic, Pacific, Arctic* and *Baltic* (282 feet by 45 feet by 24 feet and 32 feet) were built in 1850, the *Arctic* and *Atlantic* by William H. Brown and the *Pacific* and *Baltic* by Brown & Bell. All four ships were diagonally strapped both ways, each line of straps 4 feet from center to center. More than twenty years after the date of their launching the *Atlantic* and *Baltic* were carried on the books of the American Bureau of Shipping as successful sailing ships.

The same is true of the famous paddle steamship *Vanderbilt*, 320 feet by 48 feet 8 inches by 29 feet 8 inches, built in 1855. She was fitted with seven solid transverse bulkheads and was longitudinally and diagonally strapped. So late as 1879, as a sailing ship (called the *Three Brothers*) she was considered a strong and seaworthy vessel. The last wooden ship built for the Collins Line was the *Adriatic*, 351 feet by 50 feet by 33 feet 3 inches. She was diagonally strapped like the other Collins ships.

No account of well-built large wooden steamers would be complete that failed to include the large ships built for the Pacific Mail Steamship Company, the *Great Republic, Japan, China, Arizona, Alaska, Colorado, Constitution, Henry Chauncey*, and a dozen others, many of them built by William H. Webb and all of them thoroughly and properly diagonally strapped. Some of these ships were over 5,000 tons, Custom House measurement, more than 350 feet long and 50 feet beam with 32 feet depth of hold. These larger wooden ships were double diagonally strapped and double planked from keel to top of wales.

In 1865 the Royal Dockyards of Great Britain were building 50-gun wooden frigates 307 feet by 52 feet, whose frames were diagonally strapped with iron straps 6 inches wide by 1¼ inches thick. Those were the days when wooden shipbuilding was understood, and no first-class shipbuilder would have considered for one moment building large wooden vessels in which ample provision had not been made to meet twisting and wrenching strains.

Many large wooden schooners have recently been built on the Pacific Coast and elsewhere in which no suitable provision has been made to meet twisting strains. These vessels must inevitably prove dangerous, expensive investments, liable to start their seams leaking in heavy weather. No form of keelson construction, no matter how massive, can remedy this defect—even a longitudinal bulkhead running the whole length of the vessel is no solution of the problem.

Twisting strains such as a ship is subjected to when "wallowing" diagonally across seas is a skin strain and acts like all torsion strains along diagonal lines in the outer skin or planking. It must accordingly be met by diagonal skin strength. Vessels built on the "bread and butter" principle, as applied to their planking—two diagonal courses of planking under an outer fore and aft course of planking—are well calculated to meet these strains, and such vessels are certainly strong in this particular. Wooden vessels built without diagonal straps can be and have been cured by the application of an outer or inner course of diagonal planking. The British Royal Dockyards usually applied Sir Robert Seppings' diagonal trusses on the inside of the ship between the bilges and the shelf pieces of the lower hold.

Wooden ships can be built to stand any strain that ordinary sea service may impose, and that, too, when of much larger size than any yet constructed. The problem of the large wooden ship is a problem of fastenings. Transverse bulkheads are necessary, because no keelson the full length of the ship is capable of supporting its own weight without sagging, let alone keep the bottom of a ship from "coming up" or "going down." A "hog-frame," similar to those used so successfully in Sound and river steamboats, or a truss running fore and aft reaching from the top of the keel to the underside of an upper deck, running continuously for at least three-fifths of the ship's length, can without doubt prevent "hogging" or "sagging," if properly designed.

A ship is a hollow girder and most wooden ships have suffered in the past from lack of longitudinal strength in their decks. A wooden ship 420 feet long by 60 feet beam by 42 feet deep is a perfectly practical proposition; it is simply a question of locating the proper material in the proper way in the proper places.

New York. JOHN L. BOGERT.

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Solving the Problem of the Ships*

World's Insatiable Demand for Ships Rapidly Developing America's Steel and Wooden Shipbuilding Resources

BY GEORGE J. BALDWIN †

SHIPS, and how to get them, fill more space in the newspapers of the whole world than any other topic except the war. In the absence of governmental restrictions, a shortage of ships can never be local. Just as the wind moves to fill in a low-pressure area, so have ships hastened to the places they were needed. The desire to avoid competition has been a great distributor of ocean tonnage. Ships have sought far and wide for new trades and new routes. Before the war all the world had its service; any port that could furnish a reasonable tonnage and a safe anchorage was a port of call.

Of late war law has superseded economic law. The fine balance has been destroyed. Governments have commandeered hundreds of vessels for use in the North Atlantic, and hundreds of others have been tempted into the danger zone by freight rates unequaled in modern times. Ships that have done a lifetime's service on the Pacific are now plying regularly between New York and Liverpool. From Quebec and Halifax cargo boats built for service on the Great Lakes are putting forth as ocean freighters. All the far-away places of the world have felt the strain and the call for ships is universal.

Demand for Ships Insatiable

Even if it were not for the submarine, the demand would be insatiable, for war is a gigantic consumer of material. But the submarine has had a very real effect on the situation. Although all estimates of tonnage destroyed are biased one way or the other, it is safe to say that the destruction of merchant tonnage alone has been 5,000,000 tons. That is equal to a tenth of the total world's ocean-going steam tonnage, or to a quarter of England's merchant marine. Apart from the huge losses of ships by the belligerents, are those of the neutral countries, all of which, without exception, have suffered. Spain, a maritime country, has lost a sixth of her tonnage; Holland also has been roughly handled, and Norway has lost more than 600,000 tons. The destruction of merchant shipping by submarines in February—and probably the same holds true of March—was more than the total ocean-going tonnage constructed in America in the entire year of 1916, and was almost equal to that completed in England the same year.

To make up these losses, building is going on rapidly wherever possible, but shortage of men or materials or both is prevalent in all shipbuilding countries. We do not know what England, the greatest shipbuilder, is doing, but the assumption is that she is hampered to an extent by naval work and by lack of engines and ship plates. At any rate, it is safe to say that the present world's production is far behind the destruction, and that even by the end of the year, when many organizations now being speeded up begin to contribute their full capacity—even then the world's shipyards will not be turning out steel ships much more than half as fast as submarines, mines and ordinary seafaring accidents have been destroying them these latter months.

It is a fortunate thing that the shipbuilding boom which was heralded all through last summer and autumn is now becoming a reality. There was great talk of new shipyards being started and of millions of tons of ships contracted for. But there is a vast difference in time between a shipbuilding company incorporated and capitalized all in good faith and a shipyard turning out ships. There is a vast difference, too, between a ship under contract and one in the water.

Wooden and Steel Shipbuilding Boom

Both the wooden and steel shipbuilding industries have, nevertheless, come ahead very well. In March there were thirty-four private steel shipyards in full operation; five of these were old yards reopened after long disuse and seven were entirely new enterprises. Plants for building steel ships are, of course, slower to put up than those for wooden vessels; but there have been some remarkable things done in that line. One shipyard on Puget Sound is turning out ships to-day on a piece of waterfront which fifteen months ago was nothing more than a meeting place for land and tide. There was not a stick standing nor a plank laid. And yet, by a rush of building a simple shipyard was thrown together, and by far-sighted and fortunate buying shipbuilding materials came on in their proper order, and within a little over a year four hulls were in the water. Two of these have gone to sea, completed ships, but the other two are waiting for engines and machinery.

Plants of this type are not full-fledged shipbuilding yards. They do nothing but assemble and are dependent upon distant engine works, boiler shops, and all manner of manufacturers, for everything that goes into their ships. A machine shop, three or four shipways, a railroad track crossing their ends transversely, and a cableway or overhead trolley to give service to each of the building ways—those are the essentials. They are simply outdoor places where ships can be put together, and as such they will serve their purpose very well in emergency times.

Obstacles to Expansion of Shipbuilding Industry

Many and varied are the factors which make expansion difficult. New organizations take superintendents, draftsmen and skilled workers from old ones, and munition plants bid against both for their men. Materials are a problem, too. The output of the steel mills is needed for so many things that a difficult question will arise as to which are the most urgent. The United States Steel Corporation has 11,700,000 tons of unfilled orders now against 4,250,000 tons two years ago. Similarly, in shipyards the world over, a dilemma exists, whether to rush fighting ships at the expense of merchant tonnage, or to give full recognition to the extreme importance of cargo carriers.

Despite all difficulties, progress is being made in American yards. A lot of last year's 600,000 tons production were lake ships unfit for ocean service, or car floats, or barges—types of little value in the present crisis. These have all been cleared away and now almost all ships on the ways or in preparation are ocean-cargo carriers. Even in the big yards on the Great Lakes sixty percent of the construction under way is being built for salt-water ser-

* From *The Americas*.
† Chairman of the Board, New York Shipbuilding Corporation.

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vice and of the maximum size which can be taken through the Welland Canal.

Quite spontaneously wooden shipbuilding has been revived within the last year, and more than forty yards are building ocean-going ships of various types. The plants are scattered along both seaboards and the Gulf coast. Vessels of a thousand tons or more are being built in Maine, Massachusetts, Connecticut, Maryland, North Carolina, Georgia, Florida, Louisiana, Texas, California, Oregon and Washington. Four-masted auxiliary schooners of 2,000 or 3,000 tons deadweight capacity predominate, but ships as large as 3,500 tons are not uncommon, and a number of wooden steamers are in process of construction.

The speed with which a wooden shipbuilding yard can be gotten under way is amazing. More than one yard on the Coast has turned out its first ship six or seven months after the ground was cleared for the plant. Wooden ships like those being built at present and larger ones like those planned by the shipping board may prove to be of incalculable value in the present emergency.

Wooden Shipbuilding an Emergency Measure

How desperate is the need for ocean-going ships is shown by this move to resort to wooden ships. More than a generation ago the steel hull drove the wooden ship from the paths of commerce. Economy of operation did it and will do so again when the commercial life of the world returns to normal. Wooden ships are being built to-day with the knowledge that they must pay for themselves quickly and that within a few years they will be superseded by steel, as were their predecessors. But in the meantime they will serve an admirable purpose and their presence is justified economically as well as by war's demands as long as steel and labor command present prices.

The ocean-carrying trade need look for no let-up after the war, nor need shipbuilding companies fear slack times as far ahead as one can see. Regardless of the wants of a world that has been awakened from pole to pole, there will be two immediate tasks to perform. One is the carriage of all the expeditionary forces in Europe and Asia back to their homes in Canada, New Zealand, Australia, India, South Africa, Morocco. The other is restocking Europe, especially the Scandinavian and German countries. These are gigantic tasks, to be sure, and they will increase the call for ships and maintain freight rates for a considerable period, but when they are nearing completion the war's real effect upon commerce will begin to appear. An intensifying of demand, of production, of trade the world over will be seen.

Readjustment of World's Trade

The commercial relationships of the world have been shuffled like a deck of cards. Groups of nations have had to shift their trade interdependencies. New trade routes have come into being, new steamship lines have been established, new industries have sprung up. People have learned to accept strange goods from new purveyors. New implements are used in their work and new foods are found upon their tables. After the war not all these new things will remain, nor will commerce slip back into its old grooves entirely. There will be part of the new and part of the old. There will be, as never before, an educated demand for a great variety of commodities. More production and consumption and an intensified life for the entire world are assured.

The thought of the millions of men who have traveled far and seen and learned—men who would never have traveled at all but for the war—likens it to a stupendous World's Fair. And upon these men and the countries to which they return it will have an incalculable quickening effect. History has its parallel in the Crusades, which brought about the introduction of eastern culture into Europe and led to the Renaissance.

Russia in the Market for Ships

The awakening of Russia is in itself an event which contains untold possibilities. A vast territory hitherto locked up awaits development. The Russians are even now in the market for a large number of ships, and new steamship lines are planned after the war. Of these, the first to be established, according to the manager of the Baltic and White Sea Conference, are likely to be one from the Baltic to French and Italian ports, one from the Baltic to the White Sea, and one from Odessa to London, and another from Finland to America.

The whole world is planning steamship routes; and since America has the materials, it is and will be for years to come her task to build the ships.

Bulk Oil Steamship Wm. G. Warden

Third of Five Sister Ships of 15,000 Tons Deadweight Carrying Capacity Building at Newport News for Standard Oil Company

THE bulk oil steamship *Wm. G. Warden*, recently completed by the Newport News Shipbuilding and Dry Dock Company, Newport News, Va., for the Standard Oil Company of New Jersey, is the third of five duplicate vessels built and building for the same owners by this company. The preceding vessels of this type are the *Charles Pratt* and *H. H. Rogers*.

These vessels are by far the largest tankers yet constructed in the United States and are only slightly exceeded in size by a few tankers in the entire world. Some idea of their enormous capacity may be obtained from the fact that each vessel has a tank capacity for over 5,000,000 gallons of cargo oil. They are of the flush-deck type, with a total length of 517 feet, a beam of 68 feet, a depth to shelter deck of 38 feet, and have a deadweight carrying capacity when loaded to a draft of slightly over 27 feet of nearly 15,000 tons.

In common with modern practice in tank ships the propelling machinery is located aft, and, as is now becoming quite customary, they are twin screw vessels. Each vessel has ten main oil tanks, divided by an oil-tight centerline bulkhead into two compartments each, thus making twenty compartments. In addition, there are on each side of the vessel in the wings between the main

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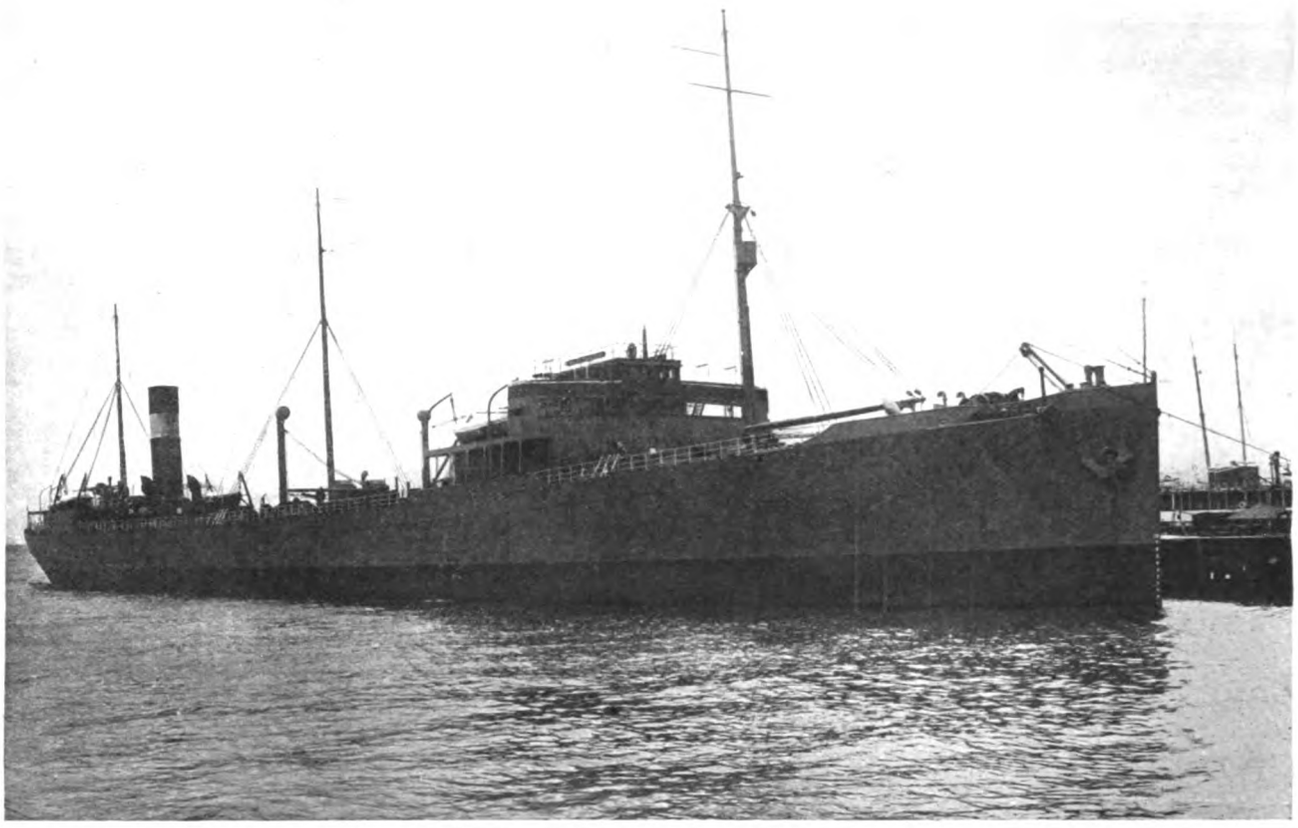

Tank Steamer *Wm. G. Warden.* Length, 517 Feet; Beam, 68 Feet; Depth to Shelter Deck, 38 Feet; Deadweight Capacity on 27-Foot Draft, 15,000 Tons

and upper decks six summer tanks, so that there is a total of thirty-two oil compartments, the combined capacity of which makes up the grand total of 5,000,000 gallons.

These tanks are so subdivided by cofferdams and pump room that three entirely different grades of oil may be carried at the same time without possibility of mixing. In all there are four complete atwartship cofferdams for the purpose of subdividing the oil tanks, to separate the latter from the general cargo space and the bunkers, and to separate the boiler room from the bunkers.

In addition to the tanks for the cargo oil the main bunkers are arranged so as to carry either fuel oil or coal, and there is also a deep tank forward divided into two compartments in which fuel oil may be carried, a total tank capacity of 475,000 gallons of fuel oil being provided, which is the equivalent of about 1,700 tons.

Coal bunkers are also provided for a total capacity of 2,000 tons, so that whether using oil or coal for fuel the vessel has capacity enough for at least forty days' steaming at full speed at sea, which will allow it to steam 10,000 miles without refueling.

The general appearance of the *Wm. G. Warden* is very much like that of the somewhat smaller tankers *John D. Archbold* and *John D. Rockefeller,* built by the Newport News Shipbuilding and Dry Dock Company for the same owners in 1914. The new vessel, however, has three masts, whereas the earlier ships were rigged with two only. The living accommodations are unusually complete. There are private baths for the captain, chief engineer, doctor and purser, as well as separate baths for the deck officers, engineers, petty officers, firemen and sailors. All living quarters are heated by steam. A hospital is one of the modern features, as is also a radio telegraph outfit. The total complement of the vessel will number about sixty-six.

The vessel was built under the special survey of Lloyd's Register for the highest classification awarded. A combined system of longitudinal and transverse framing is used in the construction, some of the features of which have not heretofore been used in any other vessel built in the United States, and this, coupled with the unusual feature of expansion trunks over each main oil tank of two full deck heights, makes this type of vessel of more than usual interest.

As heretofore mentioned, the vessel is provided with twin screws. The motive power consists of two sets of triple expansion engines with a total of 3,000 indicated horsepower, for which steam is furnished at a pressure of 215 pounds per square inch by three Scotch boilers, each 15 feet 9 inches diameter by 11 feet 6 inches long. The boilers are provided with a hot-air system of forced draft and are so equipped as to use either oil or coal for fuel. Each engine has its own auxiliaries, thus providing additional insurance against a possible breakdown of the entire propelling machinery. A large donkey boiler is fitted for supplying necessary steam for port use.

The appliances for handling cargo oil are necessarily quite elaborate. For this purpose there are two large

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pumps installed in a separate pump room located near the middle of the oil tanks. These pumps are connected to the several oil tanks by two lines of piping for each of the three subdivisions into which the cargo oil may be graded, and so connected that the two kinds of oil may be loaded or discharged simultaneously. Valves are so fitted as to enable either pump to draw from any compartment and deliver into any of the other compartments, and also that either or both pumps can discharge separately to either or both sides of the vessel. Appliances are fitted for exhausting the oil vapor from the tanks and steam coils are also fitted in the tanks for heating the oil when necessary to facilitate pumping thick or heavy oils.

For lighting the vessel there are two generating sets of 20 kilowatts each, and in addition, an emergency set. The steering gear, windlass, winches, etc., are all steam driven and are all of high grade. A refrigerating plant with a capacity of 2 tons of ice per day is provided for cooling the ship's stores.

The entire equipment of the *Wm. G. Warden,* as well as its size, is such as to make it a notable addition to the American merchant marine. The vessel left Newport News on its maiden voyage on February 3, bound for the Mexican oil fields.

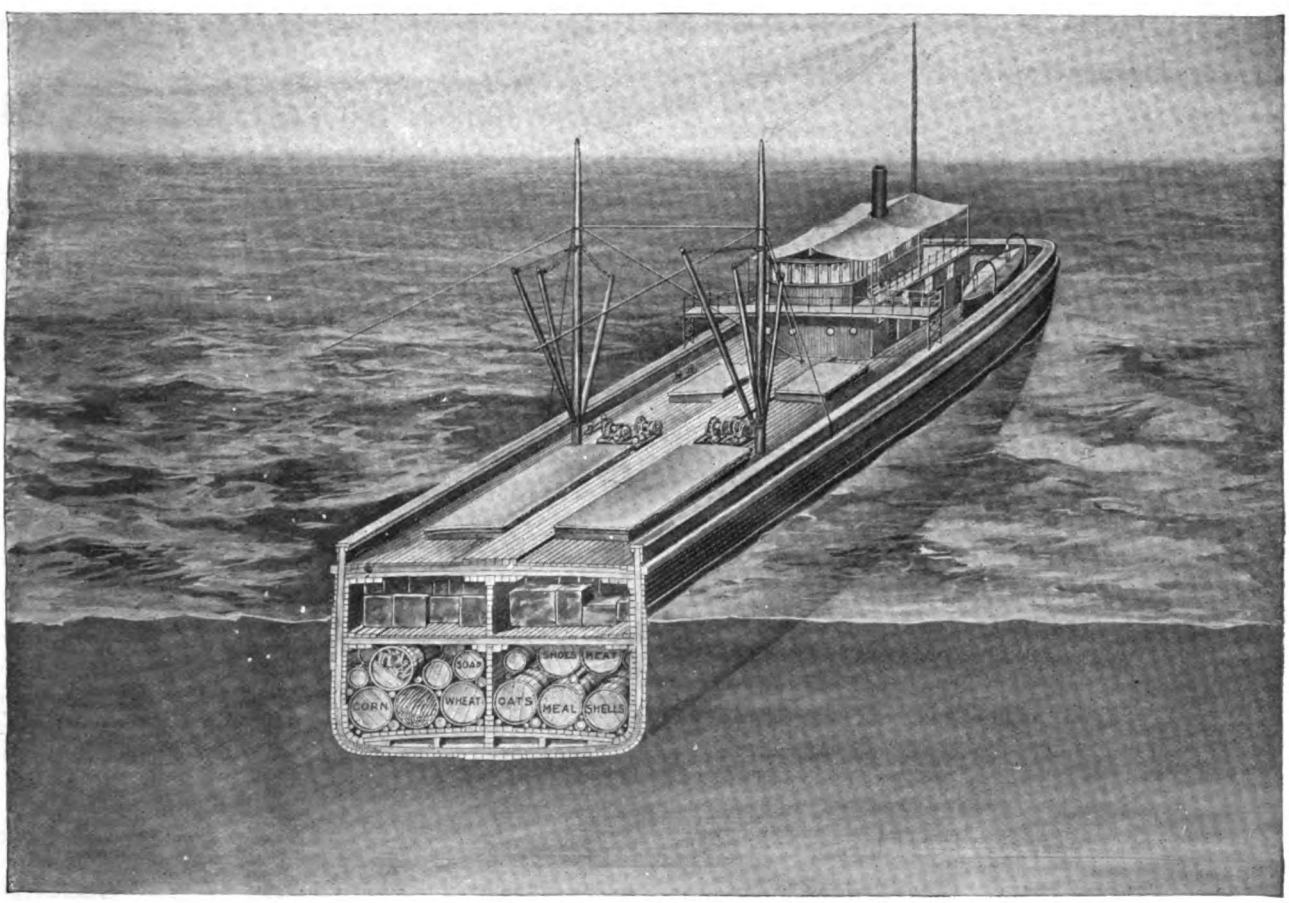
Wooden Ships and the Submarine Menace

Vessel and Cargo Made Unsinkable by Loading Cargo in Watertight Containers—Method Applicable to Steel Ships

BY WILLIAM T. DONNELLY

THE following is offered as additional information applying directly to the possibilities of the wooden ship, as illustrated and described on page 206 in the last number of MARINE ENGINEERING, and as a contribution to the problem of defense against the submarine.

The 350-foot wooden ship referred to, having a carrying capacity of 5,500 tons deadweight, would require for its construction 1,500,000 board feet of lumber. This lumber would weigh 40 pounds per cubic foot, or a total of 2,235 tons. Its volume would be 125,000 cubic feet; therefore if it was totally submerged it would displace this amount of water, which would weigh 3,570 tons, and it would then have a buoyancy or lifting power of 1,335 tons.



Section of Wooden Cargo Steamer of Donnelly Design, Showing Cargo Loaded in Watertight Containers, Making Ship and Cargo Unsinkable

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There would be required in the construction of this hull metal fastenings of not more than 7 pounds per cubic foot, or 390 tons.

In case the machinery for this boat were the smaller type of semi-Diesel engines, furnishing electricity to electric motors, the total weight of propelling machinery would be not more than 200 tons (see page 211, May issue). The weight of the deck equipment for handling cargo would be approximately 50 tons, and the forward gear for handling anchors, etc., 45 tons, or a total of 685 tons.

Two hundred and fifty tons of fuel oil would have a specific gravity slightly less than water, and for itself would not require any support. If contained in steel tanks, they would have a sufficient extra capacity beyond that required for the oil to float themselves. From this it will be seen that a wooden ship, fully equipped, without cargo, would have a reserve buoyancy of at least 650 tons, and could be waterlogged but not sunk.

Cargo Loaded in Watertight Containers

To make the ship safe, loaded, it is only necessary to place the cargo in watertight containers, each of which in itself has a displacement greater than its own weight (see illustration), or, when the nature of the goods is such that the specific gravity is less than water, it is only necessary to waterproof the package or case.

For carrying grain, sections of large wooden pipe 10 feet in diameter would be built up within the cargo space of the vessel, and then filled with grain. Each pipe or barrel would be separately sealed and of ample strength to resist water pressure from the outside.

A careful analysis of this problem shows that there would be required for a cargo of grain 1,920 lineal feet of 10 feet inside diameter wooden pipe, which would have a weight of 500 pounds per running foot. This pipe would occupy or displace 168,960 cubic feet, corresponding to a buoyancy of 4,830 tons. It would have a capacity for 150,000 cubic feet of grain, which at 48 pounds per cubic foot would weigh 3,200 tons. The weight of the pipe itself would be 430 tons. The difference between this weight and 4,830 tons would give a margin of buoyancy for this cargo of 1,200 tons, which, added to 650 tons net buoyancy for the ship itself, would make a total net buoyancy of ship and cargo of 1,850 tons.

The cargo of grain within these pipes at 60 pounds per bushel would amount to 119,500 bushels. This could be increased by closing in the space between the cylinders and filling with grain. These spaces could be readily waterproofed. This arrangement would increase the cargo by 45,000 bushels and the reserve buoyancy by 400 tons, and the total cargo of grain would be 164,500 bushels.

Ship Safe with All Compartments Flooded

The foregoing calculation is based upon the specific gravity alone; in other words, upon a condition wherein water could enter freely every compartment of the ship, which in all probability would never occur from submarine attack, as it is well known that a torpedo causes destruction within a radius not greater than 25 feet from the point of attack.

The value of the foregoing cargo of grain at prices now prevailing, $3.47 (13/7) per bushel, New York, would be $570,000 (£117,000), and the first cost of installing wood pipe containers, as per estimate of reliable parties, not more than $40,000 (£8,200). It will be understood that other cargo can be stored in some of these containers for a return voyage. Any class of cargo can be carried, the only provision being that the weight shall be kept within the requirement that the total weight shall not exceed the displacement of the cylinder.

It is not at all necessary that all cargo should be placed within the cylinders, for if the cylinders are carried empty and the bulk cargo placed in the hold below or around them, the buoyancy of the cylinders will maintain the ship afloat when water enters.

The foregoing method of rendering ships unsinkable does not depend upon any theory or device, but simply upon the well-known properties of materials, and the division and storing of cargo in a scientific manner. While the illustration of a grain cargo has been taken, ammunition or any mixed cargo can be treated in the same way. Attention is called to the fact that very little reduction from the full cargo is brought about by this method of loading.

Method Applicable to Steel Ships

While the foregoing method of loading applies with very great advantage to the wooden ship, it is in a lesser degree applicable to the steel ship, but in the case of a steel ship of equal size, she must start off with a deadweight handicap of 3,100 tons, which, owing to the fact that it is entirely made up of iron having a specific gravity of 7.85, will be reduced only approximately one-eighth of its weight by total submergence; in other words, the fully equipped steel ship has a force of 2,700 tons dragging her down when water enters, whereas a similar size of wooden ship has a net buoyancy of 650 tons supporting her when full of water.

By subdividing the cargo carriers and making them watertight, it is not only possible to support the deadweight of the steel ship, but a very considerable amount of cargo. This is in a much larger proportion as the size of ships increase, and is a very practical method as applied to a steel cargo ship of approximately 10,000 tons deadweight carrying capacity.

Heine Boilers for First Ships of New United States Emergency Fleet

Contracts for the first ships of the new emergency fleet being built by the United States Shipping Board under the supervision of Major-General Goethals were recently awarded to the Los Angeles Shipbuilding & Dry Dock Company, Los Angeles, Cal. This contract calls for eight steel vessels of 8,800 tons deadweight capacity, 426 feet long and 54 feet beam. Each of these vessels will be equipped with four standard Heine marine oil-fired boilers built for 200 pounds working pressure, each boiler containing 2,900 square feet of heating surface. The negotiations for the boilers, 32 units in all, were consummated by Mr. Samuel L. Naphtaly, vice-president of the shipbuilding company, and Mr. E. C. Meyer, president, and Mr. Paul H. Brangs, director of the Heine Safety Boiler Company.

Omission

In the article entitled "Oxy-Acetylene and Oxy-Hydrogen Welding and Cutting in the Marine Field," published on page 182 of our April issue, the name of the author was unfortunately omitted. This article was contributed by Mr. Henry Cave, director of technical research of the Davis-Bournonville Company, Jersey City, N. J. Mr. Cave has been intimately connected with the oxy-acetylene industry for many years and has been one of the most frequent and authoritative contributors to the literature and information on this subject. The "Navy Type Plants" and the radiagraph described in the article were developed by the Davis-Bournonville Company.

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Standardization as Applied to the Machinery for Cargo Boats*

Possibilities of Standardized Manufacture as Applied to Cargo Boat Engines, Boilers and Auxiliaries—Divergence of Existing Rules

BY D. B. MORISON

AN experiment in the standardization of cargo ship machinery has recently been made by the North-East Coast Institution of Engineers and Shipbuilders. The members and council have commenced on very conservative lines by preparing a guidance specification for triple expansion engines for cargo boats, based on the best practice of the various specialized builders on the Coast. It is proposed to begin on simple lines for this year, but an annual revision will be made in order that the specification may be gradually extended and kept thoroughly up to date with a view to securing the maximum rate of progress in technical advance and commanding the confidence and promoting the ultimate interests of all concerned, viz., of the engine builder, the shipbuilder and the shipowner. Other specifications on similar lines are to be prepared for quadruple engines, geared turbines, and internal combustion engines.

Progressive Improvement Necessary in Standardization

Assuming that in the general problem of standardization this guidance specification of the North-East Coast Institution represents the best now obtainable, the next step is to provide means whereby there shall be progressive improvement by continuous investigation and research, supported by organized and collective practical experience. With regard to the latter it is not sufficient that the engine builder gets rid of his goods on the day of the trial trip. There should be some system of co-operation between the engine builder and shipowner whereby the general results in coal economy and costs for repairs over a prolonged period, certainly beyond the usual six months' guarantee, are recorded and rendered available. In order to secure the funds for carrying out this scheme it has been suggested that the cargo boat engine builders of the North-East Coast should be invited to adopt the specifications at a small fee per horsepower. As the money so collected would be entirely devoted to promoting the progress of the associated industry, it is hoped and expected that there will be an enthusiastic response.

Standardizing Auxiliaries

In the matter of auxiliaries the research committee appointed by the Council of the North-East Coast Institution will exhaustively test approved apparatus connected with a marine installation and publish in their Transactions the results obtained. This will secure a reliable means of ascertaining the true performance of any apparatus so tested, and as the results will carry the hall-mark of the Institution for accuracy, the value of the scheme to the industry generally is obvious.

In the matter of boilers and shafting, complete standardization of marine machinery is blocked because the Board of Trade, Lloyd's Registry, and the British Corporation issue independent rules which are based on physical facts as a constant and individual opinion as a variable. Just a very little co-operation and mutual sympathy would enable all the existing differences to be adjusted, to the great advantage of the many industries involved. Manufacturers generally anticipate with confidence that these authorities will do their part in promoting national progress by working together with this object.

When Lloyd's Registry revised their rules some years ago they requested the assistance of a committee of experts selected by the leading marine engineering institutions. This committee has been very successful, as the various members, all of whom occupy leading positions in the several shipyards and engine works, are in such direct touch with practice that their experience establishes mutual confidence, to the great benefit of all concerned.

Committee of Experts for Revising Rules

A similar committee of experts was appointed by these institutions about the same time, with the object of providing a means whereby the many irritating disputes and misunderstandings which so frequently arose some years ago between the Board of Trade and the manufacturers could be overcome, the collective technical experience of the members being available in the event of new rules being issued or old rules revised. Each member of the committee was prominently associated with a shipbuilding yard or a marine engineering works, and all gave their services with enthusiasm, although often at great personal inconvenience. In any progressive country on the face of this earth except our own such a committee would have been welcomed, and its expert capacity officially recognized and utilized to the fullest extent for the common good; but the traditional antagonism to innovation, no matter how desirable, has prevailed. For twenty years this committee has given of its best to the cause of progress. It has never received adequate recognition or encouragement from the Department of State it was appointed to assist. It is gratifying to record, however, that a serious attempt is now being made to devise some mode of procedure for making full use of the existence of this committee in the national interests.

Standardization Applied to Boilers

Assuming the various surveys decide to harmonize their rules so that standard design, scantlings, and physical properties of material may prevail throughout the range of cylindrical boilers as now supplied to cargo boats, the economic effect on the manufacture of the material and the building of the boilers would be very pronounced. It would at once be possible to prepare a series of standard designs, with accompanying specifications for plates, furnaces, tubes, stays, rivets, etc. The steel manufacturer could estimate the probable demand, produce in bulk and give immediate delivery. The boiler builder would be freed from the delays arising from the preparation and submission of designs, and would simply order from the scheduled list—receive the goods exactly when required, and proceed with the manufacture with an economic continuity hitherto impossible.

* Paper read at the Institution of Naval Architects, London, March 28.

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The following are examples of divergence between the surveys:

1. For a single-ended boiler 15 feet 6 inches in mean diameter, 11 feet 6 inches long, 180 pounds working pressure, thickness of shell 1 13/32, tensile 28½ tons to 32½ tons per square inch, diameter of rivets 1 3/32, pitch of rivets 9½.

Working Pressure of Shell

	Pounds
Board of Trade	= 183
Lloyd's Registry	= 210½
British Corporation	= 204½

2. For the working pressure for a suspension furnace 3 feet 10 inches inside diameter, ⅝ inch thick:

	Pounds
Board of Trade	= 185.3
Lloyd's Registry	= 200.5
British Corporation	= 196.5

An examination of the tables of pressure for these furnaces reveals to the curious that for thickness below 9/16 inch the Board of Trade allows a greater working pressure, the thinner the furnace, than Lloyds, and for furnaces over 9/16 inches thick Lloyds allow a greater working pressure, the thicker the furnace, than the Board of Trade. Arbitrary requirements also often involve unnecessary cost, as, for example, limitation by the Board of Trade of rivet pitch to 10½ inches, with a tensile of rivets of from 27 tons to 32 tons, necessitates an increase in shell tensile for large boilers, for which abnormal extras have to be paid to the steel makers. A brilliant example of what can be achieved by well-directed collective effort is the standardizing of stationary boilers in the United States of America by a committee of experts appointed by the American Institution of Mechanical Engineers. In this connection the following extract from a speech by the late president of the Board of Trade would seem to be appropriate: "It will, in fact, be apparent to all close observers that a country which fails to regulate and foster its industries in the national interest cannot in the nature of things long survive the rivalry of another country where the industries are so regulated and fostered."

Diameter of Engine Shafting

The only detail of the engines proper affected by the surveys is the shafting, and the following is an analysis for a set of triple expansion engines with cylinders 25 inches, 41 inches, 68 inches, by 48-inch stroke and 180-pound boiler pressure.

Diameter of Crank and Thrust Shafts

Board of Trade	= 12.76
Lloyd's	= 13.32
British Corporation	= 13.08

Diameter of Tunnel Shaft

Board of Trade	= 12.12
Lloyd's	= 12.69
British Corporation	= 12.42

In determining the diameter of propeller shafts, each of the three surveys adopts a different basis. Lloyds and the British Corporation consider the diameter of the propeller —the British Corporation the block coefficient of displacement of the vessel, while the Board of Trade considers neither. Assuming a propeller diameter of 17 feet 6 inches and a block coefficient of displacement of 0.78, at four-fifths molded depth, diameter of propeller shaft:

Board of Trade	= 13.47
Lloyd's	= 14.29
British Corporation	= 14.67

That is to say, a shaft to the Board of Trade requirements would be deemed 22 percent too weak by the British Corporation and 16 percent too weak by Lloyds. In practice the shafting of a cargo boat is practically never made to the rules of the Board of Trade, as when the machinery is built to the Board of Trade survey it is invariably associated with either Lloyds or the British Corporation. If, therefore, these two surveys could see eye to eye and bring their shafting rules into line, a great advance could be made towards completely standardizing the reciprocating engines of a cargo boat.

With the advent of the geared turbine and its probable extended use in the near future, it might reasonably have been expected that the various surveys would at least have formulated rules on a common basis. Such, unfortunately, is not the case. Lloyds and the British Corporation adopt shaft horsepower, the Board of Trade indicated horsepower, Lloyd's rule giving the larger shaft. This state of affairs is perhaps not surprising in view of the fact that aloofness has hitherto been a national characteristic. Force of circumstances will compel us to modify this attitude, and to recognize that friendly co-operation will be the factor which will determine whether we sink or swim in the coming great race for industrial supremacy.

To obtain all that is commercially possible from standardized production it is necessary to manufacture continuously a given article in the best way by the best means at the best speed, whereby the efficiency of each factor is unity. The greater the number manufactured, the less becomes the percentage of attendant expenses. Therefore, in cases where the value of the article is considerable and the demand great, the commercial success attainable may be phenomenal. Quantity is a controlling factor in all cases, so that maximum success in the standardization of marine engines can only be obtained by the co-operation of the greatest number of builders.

Merely as an illustrative example let us consider the position on the North-East Coast. The various engineers who specialized in cargo boat machinery produce collectively, say, 200 sets of reciprocating engines per annum. The following is a rough classification of the parts of the main engines only:

Main Divisions of Engines

1.	Cylinders—	
	Cylinders	600
	Covers	600
	Liners	200
	Pistons	600
	Valves	600
2.	Columns—	
	Columns	1,200
	Guide plates	600
	Guide bars	1,200
3.	Bedplate—	
	Bedplate	200
	Bearings and keeps	1,200
	M. B. bolts	2,400
	M. B. nuts	4,800
4.	Main Forgings—	
	Piston rods	600
	Connecting rods	600
	Main bolts	1,200
	Cranks	600
5.	Valve Gear—	
	Eccentrics	1,200
	Eccentric straps and rods	1,200
	Radius links	600
	Drag links	1,200
	Reversing shaft	200
6.	Condenser—	
	Body	200
	Doors	400
	Water head	200
	Tube plates	400
	Tubes	250,000
	Ferrules	500,000

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7. Pumps—

Air pump	200
Circulating pump	200
Feed pump	400
Bilge pump	400
Sanitary pump	200
Levers, etc.	400
Drag links	800

Taking the steel forgings, and adding the thrust, tunnel and propeller shafts, the approximate total weight would be about 14,000 tons. If this amount were concentrated at a convenient center the steel cast, the ingots forged and the forgings rough turned, and if the works were of such size that this demand was only a portion of its output, then the cost of production would be so low as to enable the engine builders to buy cheaper and to sell cheaper. The destination of these forgings for machining would depend on available facilities and transport, the object being a continuity of operation under the most favorable conditions possible. The heavy castings would be produced from standard patterns, all prepared in consultation with the iron foundry management, and the design being standard, the foundry management could with confidence provide the best labor-saving tackle. When delivered to the engine works the castings would be dimensioned by means of standard apparatus and machined from continuous supply. The tens of thousands of engine valves, fittings and other details would be classified and manufactured in bulk in specially equipped departments in the best ways, by the best means and at a cost quite unapproachable by present methods.

In cases where an aggregation of parts is not sufficient to secure the benefits of production in bulk those parts should be purchased from manufacturers whose business it is to produce such parts. For example, take condenser ferrules. A condenser ferrule machine can produce 400 per hour. Even if the yearly demand were half a million, the machine would produce them in about 1,200 hours, or, say, 24 working weeks, thereby being operated at half its capacity. Complete standardized production of ferrules and similar details would involve the use of the greatest number of automatic machines that could be supervised by one skilled operator and one or more unskilled assistants. One skilled machine setter and three unskilled assistants could probably manage up to 20 automatics. Therefore, the difference between one machine working half its time with one operator and 20 machines working continuously with four operators is an indication of the possible savings by organized manufacture in bulk.

Take as another example the large bolts such as are required for main bearings, piston rods and connecting rods, and which would aggregate about 10,000 per annum. So great a number of practically similar articles would admit of the purchase of special turret lathes capable of finishing bolts up to 5-inch diameter, with provision for completing all operations from the first rough cut to the final screw cutting and finishing, and if the number of machines were adjusted to maintain their full capacity the cost of production would again be very favorable.

These few examples indicate the possibilities of standardized manufacture as applied to cargo boat engines. The system is co-operative and is the direct antithesis in its inception and in its results to the destructive competition which has been so rampant and ruinous in past years. In manufacture the day of conservative and scattered individual effort is over—it leads to certain ruin. Success lies only in concentration by collective effort and the pooling of individual interests for the common good. The industrial problems of the future must be faced, and faced quickly—moreover, they must be solved, and solved quickly. The onus of responsibility falls primarily on capital, in the provision of standardized organization, direction and equipment whereby the best is accurately determined and the best is progressively maintained; thereafter capital and labor must co-operate in standardizing rapid production, so that good general trade may be promoted by steady employment at high wages, to the lasting benefit of the industries concerned and the general welfare of the entire community.

Standardized Geared Turbines for Cargo and Passenger Steamships

Marine Turbines with Reduction Gears Aggregating More than 150,000 Horsepower Now Building by De Laval Steam Turbine Company

THE saving in weight, fuel and expense of upkeep, including attendance, achieved by the use of geared steam turbines for ship propulsion is becoming generally recognized. Over 200 power units of this type are at present under contract or construction in this country. We are informed by the De Laval Steam Turbine Company, of Trenton, N. J., to whom we are indebted for the accompanying illustrations, that over 150,000 horsepower of geared marine turbines are now going through its shops alone.

The weight of a geared marine turbine, including valves, coupling, etc., is only 40 to 50 pounds per shaft horsepower, as against about twice that weight for a reciprocating engine. The saving in space will be apparent from the illustrations. Fig. 1 shows a unit rated at 1,500 horsepower. The turbine is designed to use steam at 180 to 200 pounds pressure, exhausting to 28-inch vacuum pressure and consists of one velocity-stage wheel and seven stages with separate reversing element. The reversing wheels are capable of developing 60 percent of the forward torque. The normal turbine speed is 4,000 revolutions per minute and the propeller speed 90 revolutions per minute.

The complete unit, as shown in the illustration, weighs only about 65,000 pounds and occupies a space of 21 feet long by 9 feet wide and 8 feet 8 inches high; that is, 164 cubic feet, or equivalent to about 9 horsepower per cubic foot. The De Laval geared turbine unit shown in Fig. 2 is rated at 2,500 horsepower, but is only about a foot and a half longer and two feet wider and one and a half foot less in height, so that it occupies altogether about 177 cubic feet, giving 14 horsepower per cubic foot.

A saving of 10 to 20 percent is made in fuel consumption by the geared turbine over the reciprocating engine

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drive even in the largest vessels. As compared with the reciprocating engine the geared turbine gives a better overall plant efficiency, due principally to two factors. One of these is its ability to utilize higher superheat and vacuum than can reciprocating engines. The gain in turbine efficiency from superheat is about 1 percent for each 10 degrees F., and from vacuum about 8 percent between 28 and 29 inches, referred to a 30-inch barometer. The reciprocating engine, on the other hand, experiences difficulty with high superheats and benefits little from any increase of vacuum above 28 inches because of the limited

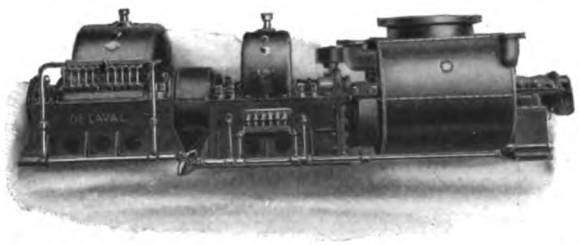

Fig. 1.—Geared Turbine Unit, Rated at 1,500 Horsepower; Weight, 65,000 Pounds

size of the low-pressure cylinder and of the valve ports. In fact, too high a vacuum results in loss from the low temperature of the condensate.

The geared turbine set shown in Fig. 3 is designed to use steam at 265-pound pressure and 130 degrees F. superheat, exhausting to a minimum of 28 inches vacuum. The turbine is of the compound type; that is, arranged on two shafts. This type of turbine is supplied where the highest efficiency is desired. It also gives the advantage of duplicate turbines in case of accident. The gears are of the standard De Laval type with rigid casings to hold the pinion and gear shafts in fixed and permanent alinement.

The turbines run at 2,400 revolutions per minute and the speed of the gears and of the propellers is 110 revolutions per minute. The ships in which the units are to be installed are twin-screw vessels, 480 feet long, 60 feet molded breadth and 12,500 tons deadweight, designed for a speed of 14 knots.

Further fuel economies are realized in turbine-driven vessels by properly correlating the auxiliaries with the

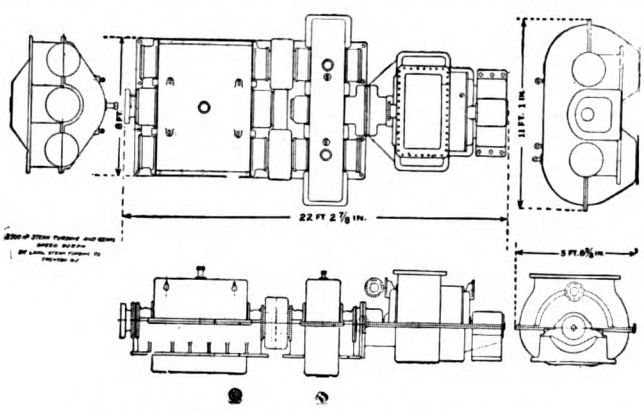

Fig. 2.—2,500-Horsepower Geared Turbine Unit

main unit. The steam consumption of auxiliaries sometimes exceeds 15 percent of the total amount of steam produced by the boilers, even when running at full power, and in the majority of ships exceeds the amount of steam which can be used for feed heating. By diverting the surplus or excess auxiliary exhaust to an intermediate stage in the main turbine this steam can be made to produce in the latter at least half as much power as it would have produced had it been received directly from the boiler.

In reciprocating engine power plants, on the other hand, surplus auxiliary exhaust is frequently bled directly to the condenser in order to save the condensate, but with a total loss of the heat of the steam. Even where it is led to the intermediate receiver of a reciprocating engine it cannot be used with much more than half the benefit gained by introducing it into an intermediate stage of a steam turbine.

The economy of the steam turbine is better maintained in service than is that of the reciprocating engine, as

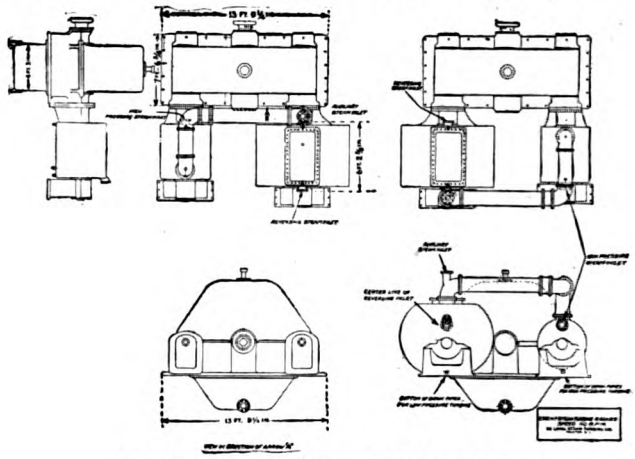

Fig. 3.—Compound Geared Turbine Unit

there are fewer parts to deteriorate and cause loss of efficiency. The turbine also shows a saving in operating expense, due to the fewer moving parts and the ease with which they are lubricated and adjusted. The oiling system is automatic and much simpler than the oiling system of a reciprocating engine. No oilers are required for the turbines.

There is no need of constant attention and frequent overhauling, such as the reboring of cylinders, refitting of valves and piston rings and adjustment of complicated valve gear. There are no packings, except the simple ones about the shaft. The consumption of oil is only trifling in comparison with that of a reciprocating plant;

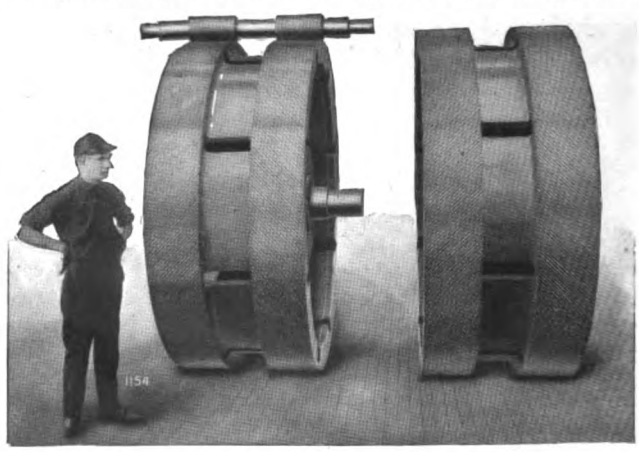

Fig. 4.—De Laval Gears for U. S. Battleship *Idaho*

there is no expense to correspond to the cylinder oil required by the latter. This fact is also of significance as regards the operation of the boilers.

The fewer number of working parts and general greater simplicity of the geared turbine as compared with other prime movers naturally leads to less expense for personnel in the engine room; that is, fewer oilers, machinists and men for general attendance and repair work.

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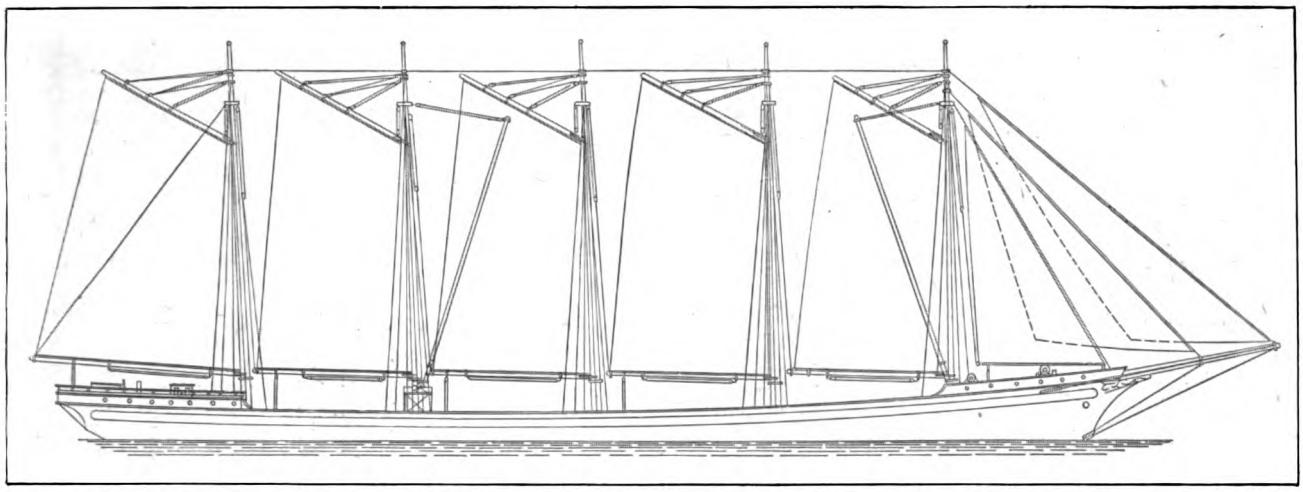

Five-Mast Bald Head Schooner, Fitted With Diesel Auxiliary Power. Length, 260 Feet; Molded Depth, 21 Feet; Deadweight Carrying Capacity, 2,700 Tons

Wooden Auxiliary Schooner

Description of 260-Foot Vessel of 2,700 Tons Deadweight Capacity—Auxiliary Power Installed

CAPTAIN O. D. TREIBOR, general manager of the National Shipbuilding Company, Seattle, Wash., has prepared plans of a standard type fore-and-aft, five-mast, bald-headed schooner with clipper bow, overhanging transom stern, topgallant forecastle, full-poop with half deck forward of same which has a deadweight carrying capacity of about 2,700 tons. While designed as a wooden sailing schooner, the vessel is equipped with auxiliary power. Space is left at the after end of the hold for an engine room arranged to accommodate two propelling engines of the internal combustion type of 180 horsepower each.

The vessel, which is built for the purpose of carrying lumber both above deck and below deck, and other bulk cargoes, is 260 feet long overall, 225 feet long on the keel, 44 feet beam molded, 21 feet depth molded and 19 feet depth of hold. In the opinion of the designer, a vessel of this size is as large a vessel as should be built of wood in order to insure durability, economy in repairs and ease of operation.

General Arrangement

The main deck runs the full length of the vessel and a line of 'tween deck beams is fitted in the hold. A watertight bulkhead is fitted forward of the machinery space and there are three main cargo hatches about 14 by 21 feet and one smaller hatch. Cargo ports are also placed in the bow on both sides. The forecastle contains the galley, crew's messroom, storeroom, lamp rack, toilet room with bath and other necessary accommodations. The poop contains the main cabin, pantry, five staterooms, including stateroom for the master with private cabin adjoining, together with toilet room, baths, storeroom, etc.

The scantlings of the vessel provide for ample strength and rigidity, the keel is 20 inches by 20 inches; the stem is sided 20 inches and molded 30 inches, while the stern post is 20 inches by 24 inches. The frames are built up of double timbers spaced 30 inches centers on the keel. They are molded 26 inches at the keel tapered to 20 inches at the lower turn of the bilge, 17 inches at the upper turn of the bilge, 12 inches at the main deck and 9 inches at the rail. The floors are sided 12 inches. In way of the raised forecastle, the frames are carried up double to the rail. In way of bulwarks, a single timber is carried up from the main deck to the rail and in way of the poop deck the double timber is carried up from the main deck to the under side of the covering board. The main keelson is 20 inches by 20 inches and the rider keelsons also 20 inches by 20 inches. Three sister keelsons of the same size are fitted on each side of the main keelson.

Ceiling and Planking

At the turn of the bilge there are five strakes of ceiling 14 inches by 14 inches and three strakes 12 inches by 12 inches beveled to fit the curve of the frame. Above the bilge the ceiling is 10 inches thick. All of the ceiling is carried the full thickness for three-fifths the vessel's length amidships, the thickness at the ends being not less than four-fifths the thickness amidships.

The planking varies according to the following schedule: garboard strake, 9 inches by 18 inches; strake next to the garboard, 7 inches by 18 inches; bottom planking, 5 inches thick; wales, 6¾ inches thick and top side planking 6 inches thick. The full thickness of the planking is carried for three-fifths of the vessel's length amidships and from there is reduced to not less than 4¼ inches at the hood end.

The main deck beams, spaced 4 feet centers, are molded 15 inches at the centerline, 13 inches at the ends and sprung with a crown of 8 inches in 44 feet. The 'tween-deck beams are spaced in alternate beams except at the hatches. They are sided 16 inches and molded 15 inches at the center, 12 inches at the sides and are sprung with a crown of 5 inches in 44 feet.

The engine room bulkhead consists of two thicknesses of 3-inch by 5-inch fir slow kiln dried and planked diagonally with a layer of ship felt between. The bulkhead is stiffened with studs 6 inches by 12 inches spaced 4 feet centers on the after side. In the engine room suitable foundations are provided for twin screw engines and all

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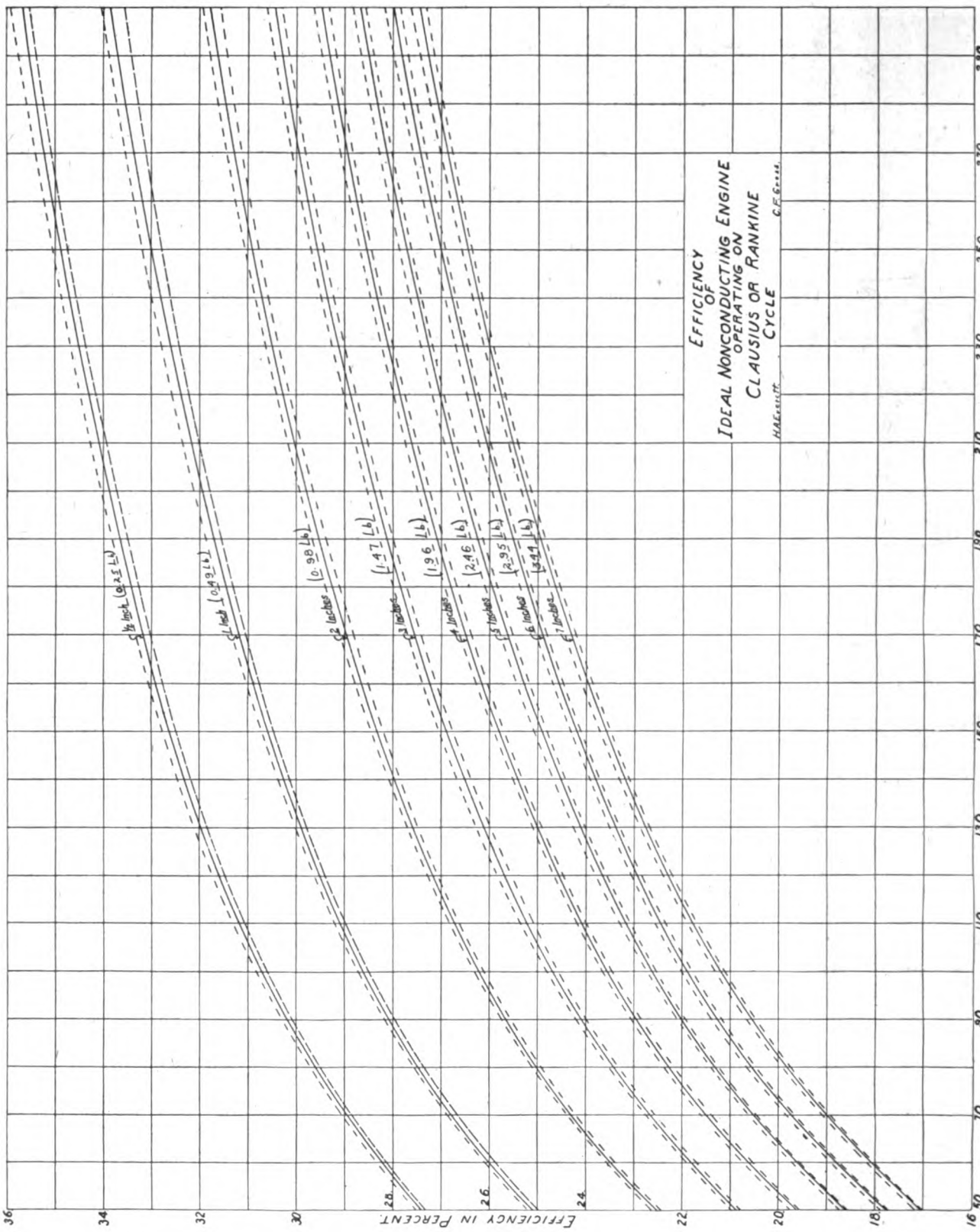
EFFICIENCY OF IDEAL NONCONDUCTING ENGINE OPERATING ON CLAUSIUS OR RANKINE CYCLE
½ Inch (0.21 Lb.)
¼ Inch (0.49 Lb.)
2 Inches (0.98 Lb.)
3 Inches (1.47 Lb.)
4 Inches (1.96 Lb.)
5 Inches (2.46 Lb.)
6 Inches (2.95 Lb.)
7 Inches (3.44 Lb.)
EFFICIENCY IN PERCENT
PRESSURE-POUNDS PER SQ. IN ABSOLUTE.

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Chart Giving Thermal Efficiency of Ideal Steam Engine (Rankine Cycle)

auxiliaries, tanks, storage batteries, etc. Fuel tanks of 1,000 barrels' capacity, built of 5/16-inch steel, are installed, as well as water tanks of 10,000 gallons' capacity, built of ¼-inch steel.

In addition to the propelling and auxiliary machinery, six cargo winches are fitted of the single-drum, two-gypsy, solid-link reversing type with cylinders 6 inches by 8 inches. On the forecastle an anchor windlass is fitted and also a 125-horsepower boiler, which is connected to all the winches and windlasses.

The name of the Brown Portable Elevator Company, Chicago, Ill., Harwood Frost, president, has been changed to the Brown Portable Conveying Machinery Company.

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Chart Giving Thermal Efficiency of the Ideal Steam Engine (Rankine Cycle)

Efficiencies Plotted on Initial Pressures with Allowances for 50 Degrees F. Superheat and 5 Percent Moisture

BY H. A. EVERETT AND C. F. GROSS

THE efficiency of the ideal steam engine (working on the Rankine or Clausius cycle), which transforms all the heat available between its admission and exhaust into work, is expressed by

$$\text{Efficiency} = \frac{H_{\text{initial}} - H_{\text{exhaust}}}{H_{\text{initial}} - q_{\text{exhaust}}},$$

where H = heat contents and q = heat of the liquid.

To minimize the labor of looking up in the Steam Tables the values for a specific problem and the subsequent calculations, the chart on page 258 has been prepared, using eight accurately computed points to define each curve.

The abscissæ are the initial pressures (absolute), the ordinates are the efficiencies, and a single curve is drawn for each final or back pressure (absolute). The dotted lines lying just above and below the full lines give the values when the initial steam has 50 degrees (F.) superheat or 5 percent moisture (priming) respectively.

Problem I.—Find the thermal efficiency of the ideal engine using dry saturated steam at 175.3 pounds per square inch (gage) and exhausting to a vacuum of 27 inches mercury. Barometer = 30 inches.

Absolute initial pressure = 175.3 + 14.7 = 190 pounds per square inch.

Absolute back pressure = 30 inches — 27 inches = 3 inches.

For these data the efficiency is, from the chart, 28.1 percent.

Problem II.—A turbine takes dry saturated steam at 235.8 pounds per square inch (gage). Vacuum = 28 inches. Barometer = 29 inches. What is the Rankine efficiency?

Absolute initial pressure = 235.8 × 14.2 = 250 pounds per square inch.

Absolute back pressure = 29 inches — 28 inches = 1 inch.

From chart efficiency is 33 percent.

Problem III.—Same as No. 1 except steam has an initial quality of 95 percent (or priming of 5 percent). Efficiency = 28.0 percent.

Problem IV.—Same as No. II, except steam has an initial superheat of 50 degrees F. Efficiency = 33.2 percent.

Marine Applications of Reduction Gears of Floating Frame Type*

Characteristics and Advantages of Floating Frame Reduction Gears —Installations on Oil Tanker and Twin Screw Passenger Steamship

BY JOHN H. MACALPINE

THE bearings of a pinion and gear are, in most machines, supported very rigidly in a heavy framework or bed-plate. Such gears will here be referred to as "rigid gears." Reduction gears designed thus had been considerably experimented with to transmit the power of the turbine, but before Admiral Melville and the author took the question up in 1904 the solution of the problem of gearing for the turbine seems to have been despaired of except for very small powers.

Assuming that the teeth could be cut almost perfectly in a modern gear-cutting machine, it appeared evident to us that one important condition was left which, for the best result, it was essential to remove—the slightest error of alinement of the pinion, which is long in proportion to its diameter, would produce great inequality of distribution of pressure along the teeth. The method we adopted for freeing the design from delicacy of alinement was very simple. It consisted in mounting the pinion bearings in a very stiff frame, supported near the middle of its length by the bedplate, but (where the teeth are not in mesh) very free to move about an axis transverse to the axes of the gear and pinion. Thus the exact position of the pinion axis at any time is in part determined by the interaction of the teeth. Great equality of distribution of tooth pressure results.

The most important conclusions regarding the floating frame reduction gear are:

1. A floating frame gear will operate perfectly with the pinion sensibly out of line, and therefore the great difficulty of rigid gears—bad distribution of tooth pressure from minute errors of alinement—vanishes.

2. That the floating frame corrects from one-half to two-thirds of the effect of torsional yield of the pinion.

3. That the performance of gears of any design should be judged by the value of the "power constant"‡ it will safely bear.

4. From published data for rigid gears, and from those given here for floating frame gears, it is clear that, as anticipated, the power constant at which the gears are usually run is much higher in the case of floating frame gears than of rigid gears.

The power constant for rigid gears appears usually to be not greater than 2, while 3.5 and 4 are perfectly safe values

‡ $$\text{Power constant} = \frac{1000\ P}{D^3\ R},$$

where P = horsepower transmitted.
D = the diameter of pinion in inches.
R = revolutions per minute of pinion.

* Paper read at the Institution of Naval Architects, March 29, 1917.

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for floating frame gears. Indeed, in the 12-hour, full-power trial of the United States collier *Neptune* the average power constant was 5.22. It has been in service for over one and a half years, and is frequently used at full power.

5. Comparing gears of different types, with a given ratio of reduction, a rise in the safe power constant quickly reduces the weight per horsepower. The higher power constant of the floating frame gear effects a marked reduction of weight over the rigid gear. Or, for the same weight of machinery, a greater ratio of reduction may be effected, allowing of a slower rotation and higher efficiency of propeller, or of a faster, smaller and more efficient turbine.

These are the principal conclusions, although there are others of some importance and many details to which I do not refer here.

I will now describe two marine installations: the first of a slow oil-tank, single-screw steamship, with double reduction; the second, a faster passenger and freight twin-screw steamer with single reduction.

Installation on Oil Tanker

Oil Tank Steamship.—This ship is being built by the Chester Shipbuilding Company, Limited. It is one of 45 freight ships of about the same power for which the Westinghouse Machine Company are building duplicate or nearly duplicate machinery.

Length	401 feet
Beam	54 feet
Draft	25 feet 9 inches
Displacement	12,650 tons
Cargo capacity	9,000 tons
Full speed, loaded	11.5 knots
Full power	2,000 shaft horsepower
Turbines	3,860 revolutions per minute
Propeller	75 revolutions per minute

There is a cross-compound turbine, the high-pressure and low-pressure parts of each actuating a separate single-pinion, first reduction gear which reduce the revolutions per minute from 3,860 to 483. There is one second reduction gear with two pinions, each first reduction gear actuating one of these, and the large gear driving the propeller shaft at 75 revolutions per minute. The turbines are aft of the gears. This arrangement allows the propeller shaft to be drawn inboard without disturbing the turbines or gears.

The ahead high pressure turbine is composed of a two-row, high pressure, impulse wheel followed by reaction blading carried on a drum. The ahead low pressure turbine has only reaction blading. Each of these turbine casings contains an astern turbine consisting of a two-row impulse wheel. The high pressure and low pressure turbines are usually operated as a cross-compound turbine; or, by suitable pipe and valve connections, either ahead or astern turbine elements can be operated singly and exhaust direct to the condenser, in case of emergency. The astern turbines can develop over 60 percent of the full ahead power with the same flow of steam.

With dry saturated steam of 180 pounds per square inch at the high pressure inlet and 28.5 inches vacuum (30 inches barometer), the guaranteed consumption of the turbines is 11.50 pounds of water per shaft horsepower hour.

	First Reduction Gear	Second Reduction Gear
Power per pinion.....(horsepower)	1,450	1,450
Pitch diameter of pinion....(inches)	5.114	10.228
Revolutions per minute of pinion....	3,800	483
Power constant	2.81	2.81

These gears are standard, designed for a maximum rating of 3,400 horsepower, with a power constant of 3.3.

The lubricating oil is pumped from a drain tank in the bottom of the ship by a rotary pump, which discharges it into an overhead gravity tank (fitted with strainers) at a height which will give a pressure of about 5 pounds per square inch to the oil at the discharge to the bearings and teeth. After leaving the gravity tank it passes through a surface water cooler and thence discharges to the sides of the bearings, where the bearing pressure is zero, and to the teeth as they are coming into mesh, so that it cannot be thrown out by the high centrifugal forces. If the level of the oil in the gravity tank should fall a short distance, still leaving a full supply for 10 or 15 minutes, an electric bell rings, warning the engineer to start an auxiliary oil pump. When the turbines are running slowly or stopped the oil is circulated by this pump.

The condenser circulating pump is driven by a geared turbine. The vacuum in the condenser is maintained by a Westinghouse Leblanc air ejector, and the condensate removed by a turbine-driven centrifugal pump. The former weighs 108 pounds and the latter 740 pounds. They replace an air pump of many times their weight.

The weight of the foregoing installation is 75 tons. This covers from the main turbine throttle and governor valve to the condenser, inclusive; also the thrust block and reduction gears (but no shafting), circulating pump, with turbine and its gear, air ejector, condensate pump, auxiliary oil pump, gravity oil tank, oil piping, and cooler.

Application to Twin Screw Passenger Steamer

S.S. Maui.—This twin screw ship is being built by the Union Iron Works, San Francisco, for the Matson Navigation Company. It will carry passengers and freight between San Francisco and the Hawaiian Islands.

Length over all	501 feet
Breadth, molded	58 feet
Draft	29 feet 11 inches
Displacement	17,500 tons
Full speed, loaded	17.5 knots
Full power	12,500 shaft horsepower
Turbines, high pressure and low pressure	2,120 revolutions per minute
Propellers	133 revolutions per minute

The turbines are cross-compound, reversible, and similar to those in the oil tank steamer. To conform to the limitations of the engine room the high pressure turbine actuates a pinion almost on top of the gear. Running either ahead or astern the high pressure turbines may be used alone, exhausting direct to the condenser, and the astern turbines can transmit 60 percent of full ahead power.

The steam pressure at the high pressure turbine inlet is 225 pounds per square inch with 50 degrees F. superheat. The contracted vacuum is 28.5 inches (30 inches barometer). Under these conditions the following performance is guaranteed:

Total S. H. P.	R. P. M. Propellers	Steam Per S. H. P. Hour for Turbines
10,000	125	11
8,500	120	10.7

There is only a single reduction from each turbine to the propeller.

Maximum power per pinion.....(horsepower)	3,125
Pitch diameter of pinion.....(inches)	7.704
Revolutions per minute of pinion.....	2,120
Power constant	3.113

The lubricating system and auxiliaries are of the same type as those for the oil tank steamer.

The weight of this installation, including the same parts as for the oil tank steamer, except the condensers, oil pipes and gravity oil tank, is 204 tons.

The introduction of the floating frame has been much accelerated during the last five or six months. There are in operation 102 gears, with a total of 126,442 horsepower; and on order 155 gears, with a total of 611,727 horsepower.

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Besides the turbines and gears for land work and for the 45 freight ships and the *Maui*, the Westinghouse Machine Company are building the gears and, in all but two cases, the turbines for six warships, including a United States scout cruiser of 90,000 horsepower and a battleship for a foreign government of 88,000 horsepower. Indeed, principally to cope with this work the Westinghouse Electric Company, who have acquired the Westinghouse Machine Company, have begun to build, near Philadelphia, Pa., works which will be several times the size of their present extensive plant.

Simplicity of Adjustment of Gear

The simplicity of adjustment of the gear and pinion is remarkable. The pinion is placed in the floating frame and, by means of two gages supplied with each gear, the distances of the centers of gear and pinion at the forward and aft ends of the floating frame are made equal; the holes for the bolts holding down the floating frame are then reamed. There is no scraping of bearings to bring the axes accurately into one plane and secure bearing all along the tooth face, as must be done with a rigid gear. The action of the teeth will do that, and, as the theory shows, however the bearings wear or alter under stress, good distribution of pressure along the teeth will be maintained. The gear is then run, usually under quite a light load, and the hard-bearing spots, if any, scraped. The work is then complete.

If the floating frame functions as stated, the wear on the teeth should be extremely small. A remarkable proof of this was given last year from the operation of the first floating frame gear installed, that at the Commonwealth Steel Company, Granite City, Ill. This had not nearly so high a power constant as is now used, but it was reported that the maximum load reached 140 percent of its rating, under which condition the power constant is 1.68. It was started on March 31, 1911, and, after running for 10 months night and day, five days per week, the load averaging 85 percent of its rating, the tool marks were still visible on the teeth. Mr. K. S. Howard, the chief engineer, has informed the author that this gear was last inspected on April 30, 1916, when they found the *scraper* marks still visible on the gear teeth. Originally these were of imperceptible depth. The driving face of the pinion teeth had taken on a very high polish and the gear was as quiet as at first. This is after more than five years of service. He further reports that since installation it has operated 24 hours per day, six days per week, with loads varying from 50 to 125 percent of rating, the average being close to full load, and he sees no reason why it should not operate satisfactorily for an indefinite period. There have been no repairs. The only discrepancy in the report is that, apparently, in the busier times of the last few years the gear has had to work under a greater average load and for one extra day in the week.

Maintenance Costs Reduced to Minimum

Again, there is a 1,000-kilowatt gear guaranteed for 25 percent overload, at the San Diego Electric Railway Company's plant in California, which has been running 19 hours per day for five years. The superintendent of motive power states that it shows no sign of wear and that there has been no maintenance cost whatever. Similarly, two 5,500-horsepower, single-pinion gears of the Cleveland Electric Illuminating Company have been in operation for four years, giving no trouble and without wear. These results are not exceptions; they are almost invariable, showing the great safety of the device in spite of frequent high power constants. A further proof of the entire absence of point contact of the teeth is that chrome nickel has never been used for the pinions, as has frequently been done for rigid gears. Nickel steel has been used twice, to meet the physical characteristics required by the United States Government; but now these requirements have been changed and the pinions are always forged of a good quality of mild carbon steel.

Relative Failure of the Marine Diesel Engine*

Success is one of those human qualities to which it is rarely possible to assign an absolute value, and in engineering progress we might almost say that there are no such things as failure and success, but only stepping stones. When, therefore, we speak of the relative failure of the marine Diesel engine, it will be understood that the phrase "relative success" would be almost as appropriate. We have to look at the matter from the point of view of how much was expected from the Diesel type in the past; how few, comparatively speaking, of those expectations have been realized, and try and imagine what progress is to be expected in the future.

We can recall the time when the Diesel engine first came to be talked about; when it was anticipated by some that its progress would be so rapid as to leave no room for any other type. And truly, if the overwhelming superiority in fuel economy had not been attended by corresponding disadvantages, there was no reason why these high expectations should not have been realized. It took about a decade for the land type Diesel to get through the period of its infantile troubles, and this type naturally had to be perfected before attention could be turned to the marine type.

We do not propose now to enter upon the history of the marine Diesel engine—the various "stepping stones" in the development of the type have been from time to time described and illustrated in our pages—but rapidly casting our mind's eye over the experience gained in the last ten years, we are forced to the conclusion that the progress has been in the direction of perfection of detail and increase of reliability, rather than in any big advance in the sphere of its application.

Broadly speaking, the marine Diesel is limited to two types—the high speed, which has its main application in submarines, and the low speed, which has been successfully applied to the ocean tramp. Of the former type it would be inadvisable to speak at length, but the limitations of the size of the high-speed Diesel were pointed out in a paper read by Lieut.-Commander Anstey at the Institution of Naval Architects eight years ago, and experience since has confirmed the conclusions arrived at in that paper. Speed of revolution, on which low weight per horsepower mainly depends, cannot be maintained as the size of the cylinder is increased, with the result that bigger powered units must be heavier, or else the increase of power must be obtained by the multiplication of cylinders.

In the type which has been developed for the tramp, weight is not a primary consideration, and here the limiting condition has been the size of cylinder. We have heard of experiments being made with very large cylinders of the order of 1,000 horsepower, but so far the results have been maintained in reserve. We are not handling an ordinary engineering problem when we come to deal with Diesel engine cylinders of, say, 50-inch diameter, which may be exposed to a pressure of anything up to 900 pounds or 1,000 pounds per square inch. The problem is more one for a gun designer than a marine engineer, and one begins to wonder whether the game is worth the candle. If we arrived at such dimensions, it is fairly ob-

* From *The Engineer*.

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vious that the weight of the installation would probably exceed that of a steam set of equal power. Not that that would be a great consideration if counterbalancing gains could be proved, but experience has shown that the larger the unit the less the balance of advantage of the Diesel engine over steam, and there must be some point at which the credit balance disappears entirely.

An argument with some who have not studied the question is that improvements are daily being made, and will still further be made, which will make further progress possible. The answer is, of course, that it is not a question of making improvements; it is that we are up against mechanical principles and laws which cannot be altered. In all questions of engineering progress similar conditions may arise. Take, for example, the question of obtaining a high speed in a vessel of a given size. Imagine that we had got to the point of progress in the design of the hulls represented, say, by an old-type, 30-knot destroyer, but imagine at the same time that our steam machinery was at the stage represented by the compound engine at 90 pounds pressure, and that the lightest form of boiler known was the locomotive type. Imagine such machinery installed in our boat, and we might probably reach 20 knots. We trace our steam machinery through its subsequent development, changing it from time to time in accordance with the improvements, but keeping the boat the same. Through all these changes we will suppose we have had an ideal in view, to obtain, say, 33 knots. We arrive eventually at the highest power we can possibly cram into the boat, and we find we can just reach 30 knots, and it has been the last two knots which have taken all the trouble to get. Probably, by making supreme sacrifices in weight, we could even get another knot, but is it worth it? The time has now come when it is necessary to abandon an unpractical though possible solution, and to find a way round it. We have imagined the hull unchanged through all this previous development; now we turn our attention to it and we find that, by lengthening the ship and increasing the displacement, we can practically begin in speed where we left off in the old type. The curve of horsepower and speed which was getting so steep as to be almost vertical at the top has, under the newer conditions, a reasonable slope, and shows us that we can still get an increase of speed with a reasonable addition of horsepower. This question of the relation of speed of vessel, and power required to produce it, is a parable of a large number of problems of engineering progress. Development begins on certain lines and proceeds satisfactorily up to a certain point; beyond that progress becomes increasingly difficult, until at last the advance made is not commensurate with the expenditure of energy required.

Some such situation has now arrived with the marine Diesel engine. Engines up to 250 horsepower per cylinder, and up to eight cylinders on one shaft, are now fairly common. The difficulties increase progressively as we pass the 250-horsepower mark, and at some point—we hesitate to give an exact figure—it will not be worth while to attempt more power per cylinder. The system then breaks down unless a larger number of cylinders is accepted, and shipowners and engineers will be reluctant to accept this solution, the former on account of cost and space, and the latter on account of complication. The problem of complication is one that has to be got round if further advance is to be made. Now, it is well to fix in our minds what we mean by complication. Multiplication of parts does not in itself constitute complication. The steam turbine, for example, has an enormously larger number of parts than a reciprocating engine, considering each blade as a separate part. It is when those parts are dependent upon one another, or form working "pairs" liable to get out of adjustment, that the objection arises to their multiplication. If it were possible to simplify valves and their gears, which are the principle sources of trouble and anxiety, we could go on multiplying small cylinders almost indefinitely to obtain the desired power. In any case, some break from the reciprocating type is necessary if we are to see high speed, or even moderate speed, vessels propelled by internal combustion engines.

Marine Engine Chart*

Graphical Determination of Dimensions of Triple-Expansion Marine Engines

By T. Addison

THE accompanying chart or, rather, series of charts, was designed to facilitate in the determination of the general dimensions of marine engines of the inverted triple-expansion type, for ordinary cargo vessels up to 6,000 tons displacement, having a maximum speed of 12 knots. The general dimensions include diameters of each of the three cylinders, stroke and diameter of crankshaft. Other dimensions depending upon cylinder diameters can be included as required.

Let us take a particular example so as to become familiar with the usage of this chart, and let us assume that the above dimensions are required for a vessel having a displacement of 4,500 tons, an Admiralty constant of 240, and that it is desired to drive this ship at 10.5 knots.

From the Admiralty formula:

$$I.\,H.\,P. = \frac{(D)^{\frac{2}{3}} V^3}{C} \qquad (1)$$

Where $I.\,H.\,P.$ = indicated horsepower,
D = displacement of vessel, in tons,
V = speed in knots,
and C = admiralty coefficient.

We have

$$I.\,H.\,P. = \frac{(4{,}500)^{\frac{2}{3}} \times (10.5)^3}{240}$$

Therefore,

$$\log I.\,H.\,P. = \tfrac{2}{3} \log 4500 + 3 \log 10.5 - \log 240,$$
$$= 2.4355 + 3.0036 - 2.3809,$$
$$\log I.\,H.\,P. = 3.1189.$$

Hence

$$I.\,H.\,P. = 1{,}315.$$

To obtain this value of indicated horsepower on the chart, obtain 4,500 on the displacement base and move vertically until the speed curve of 10.5 is reached at A. At this intersection move parallel to displacement base to B intersecting the coefficient line of 240. Again move

* Copyright by T. Addison, 1912.

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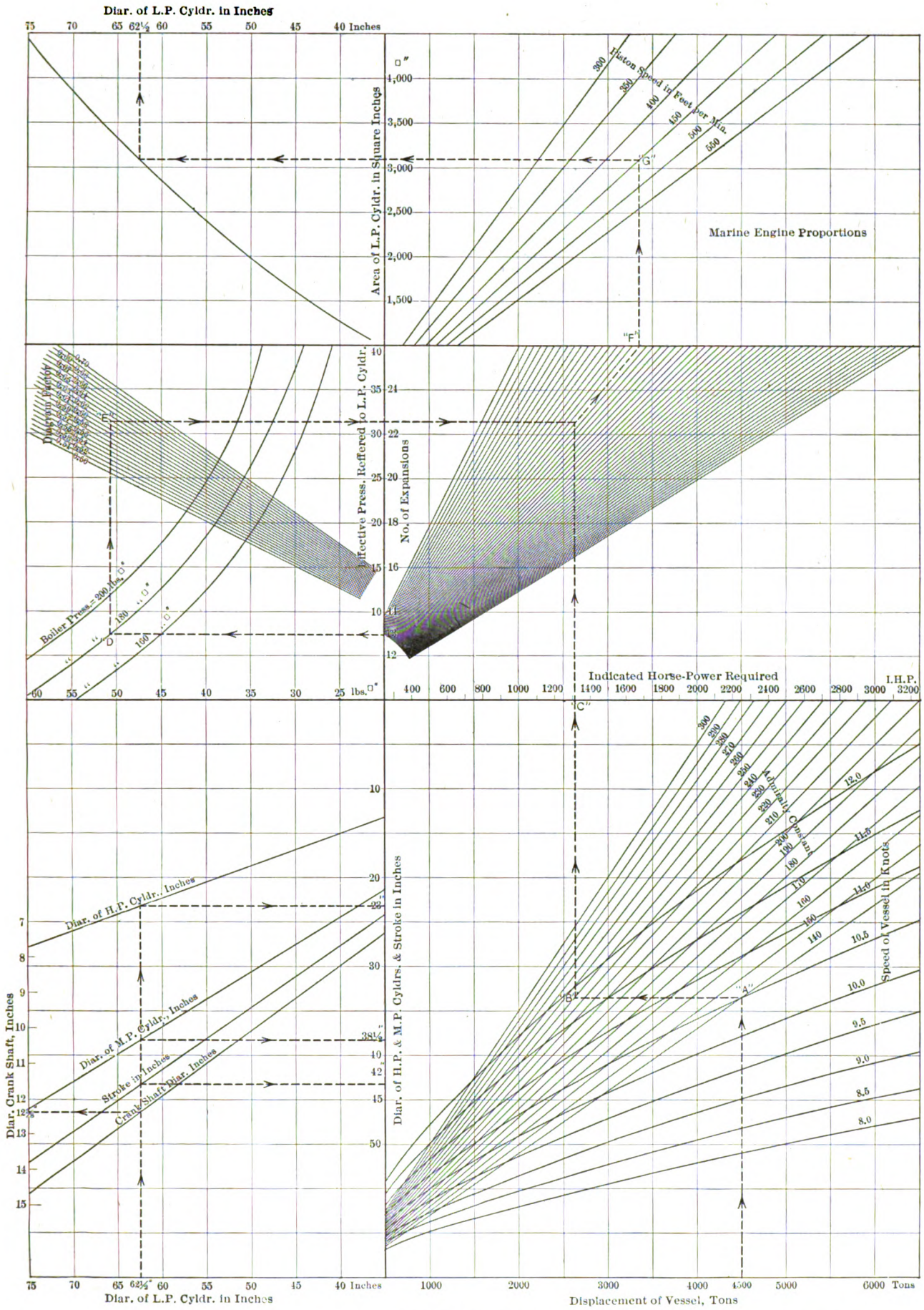
Diar. of L.P. Cyldr. in Inches
75 70 65 62½ 60 55 50 45 40 Inches
Area of L.P. Cyldr. in Square Inches
□"
4,000
3,500
3,000
2,500
2,000
1,500
Piston Speed in Feet per Min.
300 350 400 450 500 550
G"
F"
Marine Engine Proportions
Diagram Factor
Boiler Press.-200 lbs. □"
180 □"
160 □"
D"
Effective Press. Reffered to L.P. Cyldr.
No. of Expansions
40 35 30 25 20 18 16 15 12 11
24 22
lbs.□"
60 55 50 45 40 35 30 25
Indicated Horse-Power Required
I.H.P.
400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000 3200
C"
Diar. Crank Shaft, Inches
Diar. of H.P. Cyldr., Inches
Diar. of M.P. Cyldr., Inches
Stroke in Inches
Crank Shaft Diar. Inches
7 8 9 10 11 12 13 14 15
20 30 38½" 40 42 45 50
Diar. of H.P. & M.P. Cyldrs. & Stroke in Inches
B"
A"
Adoptation Constant
300 290 280 270 260 250 240 230 220 210 200 190 180 170 160 150 140
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0
Speed of Vessel in Knots
75 70 65 62½" 60 55 50 45 40 Inches
Diar. of L.P. Cyldr. in Inches
1000 2000 3000 4000 4500 5000 6000 Tons
Displacement of Vessel, Tons

Marine Engine Chart

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vertically from B to the point C on horsepower scale, this reading approximately giving the value obtained by calculation, viz: 1,315 horsepower.

Hence it can be seen that this corner of the chart eliminates the above calculation and gives results accurate enough for ordinary or preliminary calculations.

This corner of the main chart can also be of value by noting the variation of any one of the factors in the above formula by varying the value of any other factor. For instance, keep the displacement of 4,500 constant, speed constant (10.5 knots) and vary the value of the Admiralty coefficient. In other words, vary the form of the vessel.

Again, this chart can also be used to verify the Admiralty coefficient after trial trip runs, knowing the speed, displacement and indicated horsepower.

For example, let us assume a ship of 5,500 tons displacement, driven at 11 knots, develops 1,800 indicated horsepower. What is the coefficient?

From chart this value is = 230.

By calculation this value is = 230.4.

The second value to be obtained is that of mean effective pressure referred to the low-pressure cylinder.

Using the well-known formula:

$$P_m = F.\,P. \left(\frac{1 + \log_e R}{R}\right) - P_b \qquad (2)$$

Where P_m = mean effective pressure referred to low-pressure cylinder,
P = absolute boiler pressure in pounds per square inch,
P_b = back pressure in pounds per square inch,
F = diagram factor,
and R = number of expansions,

we have to assume the last three named factors.

Let us assume

P = 195 pounds per square inch (absolute),
P_b = 1.5 pounds per square inch,
R = 13 expansions,
and F = 0.61.

Inserting these values in formula (2) we have

$$P_m = 0.61 \times 195 \left(\frac{1 + 2.5649}{13}\right) - 1.5,$$
$$= 33 - 1.5,$$
$$= 31.5 \text{ pounds per square inch.}$$

Therefore, the mean effective pressure referred to the low-pressure cylinder = 31.5 pounds.

To obtain this value from the chart, first obtain 13 on the number of expansion scale. Move horizontally until the curve of 180 pounds is reached at D, and then vertically intersecting the diagram factor line of 0.61 at E. Again move horizontally to the effective pressure scale, where 31.5 pounds is obtained.

Hence this part of the main chart eliminates the calculation of formula (2).

Having obtained the indicated horsepower and mean effective pressure referred to the low-pressure cylinder, we can now use the regular formula:

$$I.\,H.\,P. = \frac{P.S.A.}{33{,}000} \qquad (3)$$

Where $I.\,H.\,P.$ = indicated horsepower,
P = mean effective pressure in pounds per square inch,
A = area of cylinder (low pressure) in square inches,
and S = piston speed in feet per minute.

Assuming

S = 450 feet per minute,

we have area of low-pressure cylinder

$$= \frac{33{,}000 \times 1{,}315}{450 \times 31.5}$$
$$= 3{,}000 \text{ square inches, or } 62\tfrac{1}{2} \text{ inches diameter.}$$

This value of 62½ inches for the diameter of the low-pressure cylinder is obtained from the chart in the following manner:

Project the original indicated horsepower value of 1,315 vertically to meet the mean effective-pressure value, projected horizontally, at point F. At this point following the diagonal lines to point G. Move vertically from G until the piston speed value of 450 is intersected, and then move horizontally to the left and the area of low-pressure cylinder can be observed. This value is transferred to diameters by means of the curve in the upper left-hand corner, and hence the value of 62.5 inches is obtained on the uppermost line of the chart.

Thus we have obtained the diameter of the low-pressure cylinder for the above assumed conditions and eliminated all calculations in so doing.

The following ratios of diameters of cylinders have been assumed and agree approximately with the practice of many well-known firms.

These are:

H. P. Area	:	I. P. Area	:	L. P. Area
1	:	2.74	:	7.4

Hence

$$\text{Diameter of high-pressure cylinder} = \frac{3{,}060}{7.4} = 23 \text{ inches}$$

$$\text{Diameter of intermediate-pressure} = \frac{3{,}060}{2.7} = 38 \text{ inches}$$

Diameter of low-pressure cylinder = 62½ inches.

These values can be obtained on the chart in the lower left-hand corner in the following manner:

From the diameter of low-pressure cylinder = 62½ move verically to lines marked H. P. and M. P.Cylinder diameters and these values can be read off scale at side.

The stroke of the engine is obtained in like manner, being equal in this case to 45 inches.

Hence we have obtained the principal dimensions of a set of triple-expansion engines for a ship of 4,500 tons displacement of coefficient equal to 240 and driven at a speed of 10.5 knots, viz: 23-inch, 38-inch and 62½-inch diameters by 45-inch stroke.

There remains one calculation to make, which is to check the number of revolutions per minute of engines due to assuming piston speed equal to 450 feet per minute.

Revolutions per minute:

$$= \frac{\text{Speed in feet per minute}}{\text{Stroke in feet} \times 2} = \frac{450}{45 \times 2} \times \frac{12}{1} = 60,$$

which is a mean value for this size of engine.

From the chart we also observe the value of crankshaft diameter equal to 12⅜ inches.

To check this diameter to see if it is satisfactory let us use Lloyds rule and also the Board of Trade rule for crankshaft diameter.

Lloyds Rule:

$$\text{Diameter in inches} = (0.038\ H.\,P. + 0.009\ I.\,P. + 0.002\ L.\,P. + 0.016\ S)\sqrt[3]{P}$$

Where $H.\,P.$ = diameter of high-pressure cylinder in inches = 23 inches,
$I.\,P.$ = diameter of intermediate-pressure cylinder in inches = 38 inches,

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$L.\ P.$ = diameter[v] of low-pressure cylinder in inches = 62½ inches,
S = stroke in inches = 45 inches,
and P = absolute boiler pressure in pounds per square inch = 195.

Hence diameter of crankshaft = 11.95 inches. Adding ⅜ inch for wear, etc., we have 12⅜-inch diameter[v].

Board of Trade Rule:

$$\text{Diameter in inches} = \sqrt[3]{\frac{\frac{1}{2} S P_a L^2}{1110\left(2+\frac{L^2}{H^2}\right)}}$$

Where H = diameter of high-pressure cylinder in inches = 23,
L = diameter of low-pressure cylinder in inches = 62½,
S = stroke in inches = 45,
and P_a = absolute boiler pressure in pounds per square inch = 1.95.

Hence;

$$\text{Diameter} = \sqrt[3]{\frac{\frac{1}{2}\times 45\times 62\frac{1}{2}^2\times 195}{1110\left(2+\frac{62\frac{1}{2}^2}{23\frac{1}{2}}\right)}} = \sqrt[3]{\frac{87890.6\times 195}{10411.}}$$

$= \sqrt[3]{1646}.$
$= 11.81 + \frac{3}{8}$ inch.
$= 12\frac{1}{4}$ inches.

[NOTE.—Blue Prints of this chart may be obtained upon application to writer.]

Compact Propelling Machinery Arrangements for Medium Size-Cargo Boats

Figs. 1 and 2 show the general arrangement of two types of steam-driven propelling machinery with Talbot oil-burning boilers for cargo ships of 44 and 56 feet beam respectively. Fig. 1 shows a twin-screw arrangement with ordinary triple expansion engines with cylinders 16 inches, 32 inches and 44 inches diameter by 28 inches stroke, designed to develop 1,000 horsepower each at 100 revolutions per minute, using steam at 185 pounds gage pressure. Fig. 2 shows a twin-screw arrangement with two 350-horsepower Talbot oil-burning boilers and uniflow engines.

With the arrangement shown in Fig. 1 when operated with superheated steam at 650 degrees Fahrenheit at the throttles, the steam consumption, as shown by numerous instances on record, is claimed to be slightly less than 12.5 pounds per horsepower hour.

The Talbot boilers shown are duplicates of the largest of this type which the Talbot Boiler & Engine Corporation, New York, has produced up to date. These boilers have proved to have a capacity of evaporation on test of 15,000 pounds of water per hour under ½-inch draft pressure. They have also proved their capacity in service, in one instance a single unit replacing a Scotch boiler of approximately five times its weight and over twice its heating surface operating under .4-inch draft pressure.

Each boiler has a width of 5½ feet, a length of 9 feet and a height of 10 feet 10 inches. The steaming weight of each boiler is 12 tons and the heating surface 1,350 square feet. An equivalent evaporation of 16.5 pounds of water per pound of heavy fuel oil is guaranteed by the manufacturers. The fuel consumption per horsepower for the main engines alone will thus be slightly less than 1 pound per indicated horsepower.

The thick bank of tubes comprising the upper heating surface, containing low temperature water, in these boilers permits a large increase of draft pressure and steam production without great loss of heat. The temperature at the uptakes has never been found high enough to require the usual inner casing of the stack or to burn the paint from a single sheet metal stack when the fuel is well atomized at the burners.

In any vessel having a beam of about 40 feet, the entire

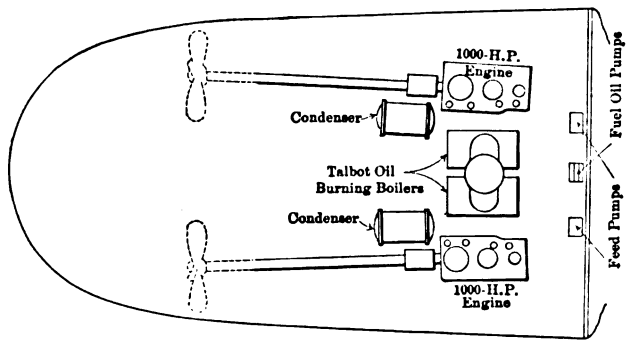

Fig. 1.—Talbot Oil-Burning Steam Plant of 2,000 Horsepower for 3,600-Ton Cargo Boat. Vessel is 288 Feet Long, 44 Feet Draft and 27 Feet Depth

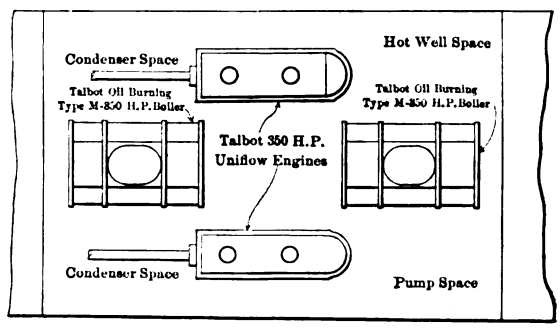
Hot Well Space
Condenser Space
Talbot Oil Burning Type M-350 H.P. Boiler
Talbot Oil Burning Type M-350 H.P. Boiler
Talbot 350 H.P. Uniflow Engines
Condenser Space
Pump Space

Fig. 2.—Talbot Oil-Burning Boiler and Uniflow Engines in Cargo Boat 110 Feet Long. Horsepower of Plant, 700

machinery space can be arranged as shown in Fig. 1, with the boilers in the fore-and-aft space required for the engines. In addition, the weight saved makes an increase of cargo space, while further gains in economy are made by the use of a low grade of fuel oil costing less but having more weight per gallon than is commonly used in oil-burning boilers. Further gains are also made as regards the use of cylinder oil, boiler compounds, gaskets and delays for cleaning boilers. Tube renewals are said to be so infrequent that the manufacturers supply new parts of the entire heating surface in exchange for worn-out or defective parts for a period of three years.

SUB-COMMITTEES OF COUNCIL OF NATIONAL DEFENSE.—The following new sub-committees of the Council of National Defense with their personnel were announced on May 9. The steel sub-committee consists of Judge E. H. Gary, James A. Farrell, Charles M. Schwab, James A. Burden, E. A. C. Clarke, president Lackawanna Steel Company; Alva C. Dinkey, of the Midvale Company, and W. L. King and John A. Topping, of the Republic Steel Company. A. C. Bedford, president of the Standard Oil Company, heads the sub-committee on oil. Chairmen of other committees are Horatio S. Rubens, director of the U. S. Industrial Alcohol Company, alcohol; Arthur V. Davis, aluminum; Charles F. Brooker, brass; W. H. Childs, coal tar by-products; R. H. Downmen, lumber; Clinton H. Crane, lead; L. W. Kingsley, mica; Ambrose Monell, nickel; H. Stuart Hotchkiss, rubber; Henry Whinton, sulphur, and Jacob F. Brown, wool.

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Why Is a Ship Draftsman?

Rush Orders, Overtime Work and the Natural Result—The Chief's "Sure Cure"

THE *Mariposa,* a trading schooner, that was having some oil engines installed, came into the yard to have the tail shafts and stern bearings fitted. At noontime she was high and dry on dock, and when Casey went out into the yard after lunch he climbed aboard and got acquainted with the captain, who invited him into the cabin and treated him to a little of his private stock. Our town is a dry town—bone dry—and such a treat as this is a treat indeed. The whistle blew, and as Casey climbed over the side and started up the dock the captain laughingly called out and asked him to come again earlier and have lunch on the *Mariposa,* also to bring a couple of his friends. Casey thanked him and said that he would be on hand early the next day, and hurried toward the office.

Casey is clever—smooth. His father is a policeman. He can do less work and appear busier than any other man in the office. His board is always piled high with reference plans and his earnest, obliging manner is misleading. He stands well with the stenographers down stairs and gets the office gossip first. He sings and plays the piano. His tracings are beautiful and his printing is just like type, but the chief will not trust him to order material or check drawings. The chief is wise.

Lunch on the "Mariposa"

The next day a little before noon Casey passed the word to Charley Adams and Mike Shanon and they disappeared via the wash-room about ten minutes to twelve. The fat captain was glad to see them and led the way into his little cabin. The table was elaborately set with a red and white cover and blue and white china. There were several large trays full of beautiful and strange-looking tropical fruit. José, whose large mustache, black hair and dark skin showed him to be a Mexican, was cook and steward. When the captain entered he was leaning thoughtfully against the galley door with an extinguished cigarette apparently glued to his lower lip. After a cocktail, everybody sat down to the table and José glided in with numerous suspicious-looking peppery dishes. Casey was wise enough to praise extravagantly each dish, at which José smiled in a satisfied and knowing way. Why shouldn't he?—he knew what each one contained.

Chili warms the stomach and stimulates the appetite and they all ate everything that José brought in. When the captain had got a comfortable tension on his own round stomach and had swallowed a small cup of black coffee, he offered the boys some Mexican cigarettes—odd-looking things with black tobacco rolled up in dark licorice paper. "Mr. Casey," he asked, "have you or your friends ever seen fruit such as I have here on the table?"

No, they had not. "Where did it come from?" they inquired.

"Such perfect and rare fruit can come from but one place in the world—'La Isla de Las Mil y Una Doncellas' (The Island of the Thousand and One Virgins)—a veritable paradise off the west coast of Mexico," replied the captain. "You never heard of it before? Huh! Do you remember hearing some time ago of the discovery of an Adamless Eden? No! Say, you fellows are so wrapped up in this miserable shipyard of yours that you never hear or see anything but turbines, rivets, plates, and the like. Honest! you have never heard of the Adamless Eden? José, they never heard of La Isla de Las Mil y Una Doncellas!"

José shrugged his shoulders and sighed in a resigned sort of way.

The Captain Spins a Yarn

"Well, about ten years ago," continued the captain, "my uncle, who then captained the *Mariposa,* landed on this island for fresh water. The island is out of the line of travel and was practically unknown. When Uncle John cast anchor and sent a boat ashore, the people, all women, ran down to the beach and carried off the astonished and unresisting boat's crew. Uncle John followed in a second and armed boat. He was met by the queen and her following, all women, and escorted in state to the village, a short distance inland.

"Uncle John spoke a little Spanish and he finally pieced out that quite a few years ago the island had been invaded by natives who came from the mainland in canoes during the time of good weather. After a protracted battle, in which the defenders lost, the victors exterminated the male population and ordered the women to prepare a feast before being taken as slaves to the mainland. This the women did, but the queen's mother, then queen, quietly put some dope in the soup, and when the men were snoring in a stupid slumber on the beach the women fell upon them and revengefully killed every last one of them. The next day a storm destroyed the canoes and the island became an Adamless Eden and remained so until the *Mariposa* and Captain John happened along.

"The queen wanted Uncle John to stick around and be king. Now, Uncle John had a garden gate understanding with a girl in Boston to the effect that after this trip he would settle down and anchor in Boston. This understanding precluded any such arrangement as the queen suggested, but he knew that he could not sail the ship back to the States alone (the crew had promptly scattered and to all appearances each one of them was very much at home), so he decided that discretion was the better part of valor and explained to the queen as well as he could in a language that he had previously used only in a restricted business way, that he would agree to filling out an unexpired term and be king—pro tem., as it were. At the end of that time it would be his duty to return to the States.

"The queen was satisfied and Uncle John entered upon a reign that was decidedly novel. Watching his chance and using the same doped soup, he finally managed to get enough of the crew on board to man the ship and get away to the States, where a close corporation was formed to colonize and repopulate the island. Of course I returned with Uncle John, and have been there ever since, returning to the States once a year only to trade pearls for a few things that some of us on the island believe we must have.

"La Isla de Las Mil y Una Doncellas is my home and always will be. It is a wonderful place. Imagine, if you can, an island in the tropics where Adams are scarce and graceful, deer-eyed, olive-skinned Eves vie with one another to cultivate your favor by bringing luscious fruit, oysters, etc., to you while you bask in a glorious sun on a silvery beach backed by gently-waving cocoanut palms

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and bathed by a beautiful blue ocean that breaks in a snowy foam at your feet. No work—no exertion, in fact, but that which is prompted by desire. Willing women gather enough of Nature's growth—farming operations such as you are familiar with are unknown on this island. There are great flocks of songbirds of gorgeous plumage. Deer, ducks and fish are plentiful. The largest and best oysters I have ever seen are found in abundance on the lower end of the island, and it is from the few of these that are gathered to eat that I annually get enough pearls to pay the expenses of the *Mariposa* and buy what is needed from the outside world. Unlike other places in the tropics, the heat here is not oppressive. Like Ireland there are no reptiles on the island. There are no mosquitoes on La Isla de Las Mil y Una Doncellas. A deep, beautiful blue lake gives us a bountiful supply of cold, sweet water. It is fed by a creek that drops into the lake over a waterfall that will some day furnish enough power for electric light and refrigeration for the whole island. A paradise, gentlemen, that may, if such a thing is possible, lack only a few more vigorous Adams like yourselves."

The boys looked at one another and José gazed pensively out of the galley door. Then the whistle blew. The captain looked disgusted. The boys got up, and after heartily thanking him, started back to the office. The captain detained Casey a minute and slipped some real estate circulars into his hand and asked him to drop around again later in the day.

Day Dreams Disorganize the Draftsmen

That afternoon was a hard one for Charley Adams. It was uncomfortable for him to reach to the far side of the board. He could not concentrate on his work. He saw lovely Doncellas carrying luscious fruit and passing in and out of the plate schedules and the frame spaces in the shell expansion.

Mike Shanon was away off also. He imagined that he sat on the captain's beach watching a restless ocean fling foam up to his feet while graceful maidens brought him large and wonderfully colored oysters, from which he selected a few of the largest and finest pearls.

Casey read and re-read the captain's literature, which even more elaborately described this marvelous Isla de Las Mil y Una Doncellas.

The chief had been instructed to rush to the limit plans for our last order for six freighters because deliveries on steel were going up six months at a jump. We had worked overtime every night for more than a week and everybody was pretty well slowed up. The idea of overtime at time and a half had been welcomed as a golden opportunity to get rich quick, but working all day and part of the night left no time to spend money. This was at last a case of all coming in and nothing going out. Mortgages would be taken off homes, autos bought and yachts fitted out. At the outset all was lovely.

Smith's young wife, with the extra money that Smith was making, was going to quit boarding and have a home of her own. After a week she complained that she hardly saw Smith any more. He came home all in and dumb except to kick about his lunch, and one night after she had commented on the poor way in which the Browns were building their bungalow and finally asked him if he did not agree with her, she found that he was sound asleep. He had never done this before, she said, and it was not a nice thing to do after she had been home alone all day and the greater part of the night. Life would not be worth living if this had to keep up.

That night work was out of the question for Adams and Shanon. The glow of José's warming dishes was gone and the reaction could not be easily met by tired eyes and a fatigued brain. A liver unaccustomed to chili holds back—goes slow, and the effect is one of depression. Gee! but ten o'clock was a long way off; it was getting cold, too. Mike looked around. Casey and Adams were down near the vault looking at a map. The chief had gone home, and a few minutes after he left Mac was called on the 'phone. He had to hurry home also. Some of us think the chief called him up and gave him an "out." Mike went over to the vault and was soon interested in the maps and pamphlets showing the wonders of the Isla de Las Mil y Una Doncellas. It was not long before everybody had gathered around and Casey was repeating parts of the captain's really marvelous and enticing description.

The "Grouch" Develops

Casey said that he was sick and disgusted with his job. A draftsman never amounted to anything nowadays. Ten or fifteen years over a board, and a man was either crazy or baldheaded—a fit subject for the nut factory. Old man Higgins, who was standing back a ways, slyly felt his head, and, finding a smooth bare spot on top, was reassured of his sanity. A draftsman is underpaid. Everybody agreed to this. Higgins spoke up and said that this could be remedied if everybody pulled for the A. S. M. D. Statistics show that in the shipbuilding business, on the average, machinists are paid the least, and draftsmen come next. All the other crafts are better paid. It used to be that a draftsman was part of the firm, but now, instead of designing and planning, he manufactures drawings. He is a skilled laborer who no longer is taken care of by the firm and who has no labor union. Some day the A. S. M. D., Higgins said, will stand for ten dollars a day and get it. Draftsmen are hard to organize. The prompt failure of the P. B. O. D. society (Poor Bloody Old Draftsmen) that went broke paying for its first banquet is a sad reminder of the first attempt at organization.

Drawing is not healthful. Hanging on the edge of a board all day displaces the stomach and organs from their natural position, irritates the breast bone, which causes coughing, and certainly knocks a man's eyes.

At this point the janitor came in and complainingly asked when we were going to be through with this overtime. He said that he and Pete, the watchman, were getting mighty sick of it all. He could not get his work finished until an unearthly hour at night and Peter could not get in his usual evening nap because there was so much noise. Somebody told him to tell his troubles to a policeman. He joined the circle and was soon very much interested in the pamphlets of the wonderful island.

A bat, that had been more or less disturbed for a week by the unusual light at night, came out of a ventilator and started looping the loop around the office. We all grabbed tee squares and gave chase, until Casey finally hit it and knocked it squeaking into a corner. It was put on a piece of paper and a lecture on bats followed. Somebody discovered that the bat was inhabited and it was thrown out the window, when the chief appeared on the scene. He had forgotten his other glasses, he said. After fussing around for a while, he went out and work stopped again.

Old man Higgins had constructed a perpetual motion machine and he had it running on his board. It had a small paper tube about ½ inch in diameter and about 5 inches long, supported on a toothpick axle in a couple of cardboard standards. Very slowly the paper tube seesawed on the toothpick axle in a sort of uncanny way. Some few of us who had seen this before knew that an ambitious fly, who persisted in walking up hill in the tube, was tipping it first one way and then the other. Tek

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thought it was done by wireless. Instinct was the motive power.

"Say, boys, let us get up a colony and go down to that what-you-may call it island," said Mike Shanon. "That captain is right. A draftsman is stuck in a quiet upper corner of an office in a shipyard which is always out of town. He never knows anything that is going on except what he reads in the newspaper. I would like to go down on that island and put in a power plant on the creek that the captain was telling us about, and I'll bet I would have a good thing of it. Just think of those oysters and that beach and those—those thousand and one girls! Say, Casey, why the one? Ain't a thousand enough?"

"Easy Street" Looms Up in the Offing

"Well, you see," replied Casey, "if he said just a thousand there might be more or less; say seven hundred and fifty. But when you say a thousand and one, then there is no question. Just like two inches plus one thousandth—absolutely definite!"

"I see," said Mike.

"And besides, Mike," said Casey, "that one is different from all the other thousand."

"Me for the island," said Mike.

"You do not have to go down to an island to make money," said Higgins. "I have a scheme that, when a few minor details are perfected, will make me barrels of money."

"What is that, Dad?"

"Well, you see, out my way a groceryman is having all kinds of trouble keeping the dogs away from his place. He has a sign up, 'No Dogs Allowed in This Store.' In they go, just the same; don't see the sign, I guess. They say a dog's eyes are not very good, anyway. Only a few dogs can read or write well, so you can't blame the dogs. They have business in the store and, of course, in they will go if they can get in. Now, my scheme is to get up a sign that will appeal to a dog—something that he can understand readily. Dogs mean to do the right thing, I think. An advertising expert and I are working this up, and as soon as we get the minor details worked out we will put it on the market."

"What are these minor details, Dad?"

"Oh, the color effect, arrangement of the characters, etc., to give pulling or drawing power, as the expert says."

"You better try the sign on a vacant lot first, Dad, because it may have so much drawing power when you two get through with it that it will draw all the dogs in the country," said Mike

Ten o'clock had come and everybody piled out, glad to get out and hating to come back the next day.

Mac and the Chief Hold a Consultation

The next day Mac and the chief got together and decided something had to be done. The whole office had gone stale, just like a college boat crew that the chief remembered. They had been trained to the minute and the date of the race had been postponed two weeks because of the college president's death. In the case of the office, too much work, irregular eating at Dan's chop house, and La Isla de Las Mil y Una Doncellas was the cause.

Mac had been watching Higgins. It was two days yet to full moon, his piping plan was not finished and he was getting the look on his face that he had when he started to look for the blue elephants in back of the vault. If he fell down on this plan a new one would have to be made, because nobody at this stage could possibly unravel it.

The chief had met Roberts' mother on the street and she had asked him not to work Roberts too hard. She said that he was just working to keep up with the rest of us, hated to quit and would wear himself down and be sick. He is a hunchback, whose patience and good humor are out of all proportion to his physical disadvantages. Mac says he is the gamest man in the office.

The only thing Mac could think of was to lay off for a day or two on the night work. "What did they do with that boat's crew, chief?" he asked.

"Broke training by riotous living for a day and a night and started all over again," replied the chief.

"Let us do that here."

"How?"

"Give a banquet on the *Mariposa*. That son of a gun of a captain has probably had something to do with all this by his alluring lies and real estate schemes in regard to that wild island he was telling us about a couple of years ago when we helped him out of that smuggling trouble—the time he had his fresh water tanks full up with ammunition, etc., for that rascal Villa. 'Old Man of the Sea' was looking at his boat yesterday, when the Mexican cook on board, unfamiliar with dock rules, dumped a bucket of slop into the scupper, which squarely caught 'Old Man of the Sea,' who happened to be directly under it. There was some blue smoke around for a while, and the captain has not yet squared himself. They say that 'Old Man of the Sea' looked comical picking Mexican beans out of his hair."

The chief and Mac went down on the *Mariposa*, and after an argument and some forceful persuasion arranged to have a dinner for the drawing office force on the *Mariposa*. The chief arranged the menu with José, who quietly told the chief that many times the fat captain got muy triste (very sad—bilious) and he had to change the cooking to overcome this. The chief wanted to know if he could do this at the dinner in the evening. "Sure," promised José. "Go ahead," ordered the chief. "If it works you get five dollars—gold. Do you understand?" "Si, señor," said José.

José Administers the "Sure Cure"

Instead of to Dan's, everybody went on board the *Mariposa*. Some feast! "Old Man of the Sea" made a speech on the riveting of ships, and because he had been so unlucky and had provided a box of cigars, we all applauded. For dessert we had what José called dulce, a sort of a sweet apple sauce. Everybody enjoyed it, and "Old Man of the Sea" asked for a second helping. José handed it to him with a peculiar smile on his face. His skin was so dark that color could not have been noticed.

We all went home early. The next day everybody seemed cheerful, ambitious and full of the old-time spirit. Higgins finished up his plan. Numerous stamps were put on tracings, etc. Old Mac and the chief felt better, too. Mac told the chief that José was some cook. The chief said, "I think so." He seemed to get an idea, got up and hurriedly went down to the dock, which was just being lowered. He just had time to get aboard and hunt up José. "Here is your five spot, José; it worked fine. I am very pleased. Tell me, how did you work it?"

"I put licorice powder in dulce. I make him much strong. Your ol' man friend take twice. Ha! ha!" laughed José.

The chief hurried off and watched the *Mariposa* finally float away in charge of a couple of tugs. All that remained was a little oil from the anti-fouling paint and a

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few chips of wood. The *Mariposa* had gone, and with her the disturbing captain, who was nothing more than a lying real estater.

That night everybody worked as usual. Old Mac and the chief stayed on the job, and there was no evidence of discontent. The chief called Mac over in a corner, and after some convulsed laughter, Mac was heard to say that the company would have to put in an order for a barrel of licorice powder and deal it out to "Greasy" Dan once or twice a week when necessary. "And 'Old Man of the Sea' got a double shot! No wonder he did not show up to-day," said the chief. "That José always had a deep look to me. You have to watch a Mexican. Licorice Powder—A Sure Cure for the Bilious Blues!"

State Nautical Schoolships

Training Officers to Man American Merchant Ships—Instruction in Navigation and Engineering

"NEVER before in the history of our country, not in the stirring times of the Napoleonic wars, not in the era of the sturdy packet ships or of the superb clipper ships, have the prospects of a sea life for the lads of our race been so advantageous and compelling as they are to-day." The foregoing statement prefaced a stirring address on "New Opportunities for Young Officers in the American Merchant Marine," delivered on February 14, 1917, by Winthrop L. Marvin, of Boston, before the Massachusetts Nautical School on board the *Ranger*.

In concluding his address, Mr. Marvin pointed out that for every sea-going American steamship of the year before this present war there will soon be two or three American ships requiring a master, a chief engineer and a full complement of watch officers, and there will steadily be other ships coming forward. "There are now building in our shipyards," he continued, "many steamers which cannot be completed before the end of 1918, and there are contracts which cannot be filled until long afterward. The destruction of allied and neutral tonnage by submarines will exceed this year by a wide margin of many hundred thousand tons the entire new shipping that can be built in America and elsewhere. Prosperity in ocean transportation and profitable employment for American ships will not cease with the war, but will continue after the war is ended. This whole nation of ours, and particularly the agricultural people of the South and West, have learned from the lessons of the war as never before the necessity for a great merchant shipping built and owned in the United States, and operated primarily in American interests."

The promising outlook, and, in fact, the urgent need for a great number of officers to man American merchant ships, should be a sufficient inducement to lead a great many young men to enrolment in the State nautical schools and other institutions where navigation, seamanship and marine engineering are taught.

It is humiliating to realize that in the past only two states, Massachusetts and New York, have maintained nautical schools for the instruction of young officers. Now, however, California and Washington have provided

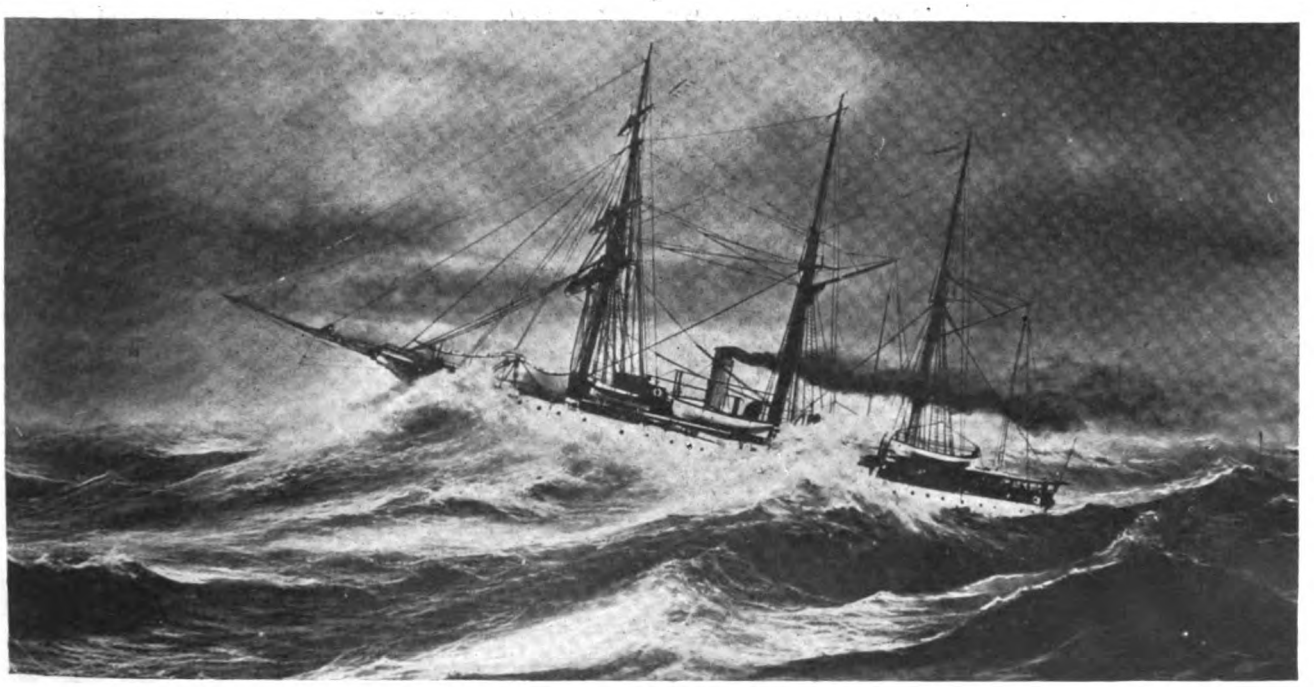

Fig. 1.—New York State Nautical Schoolship *Newport* Weathering a Storm at Sea

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STATE NAUTICAL SCHOOLSHIPS

On Board New York Schoolship Newport

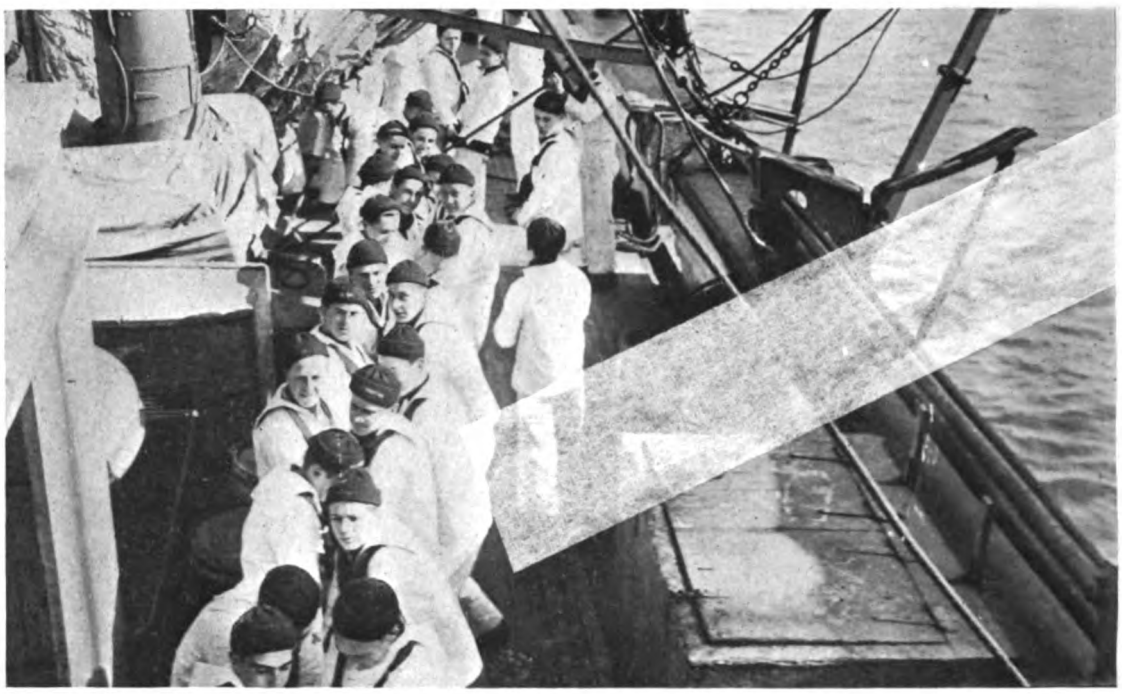

Fig. 2.—During the First Year the Cadets are Required to Do Deck Duty in Actual Handling of the Ship

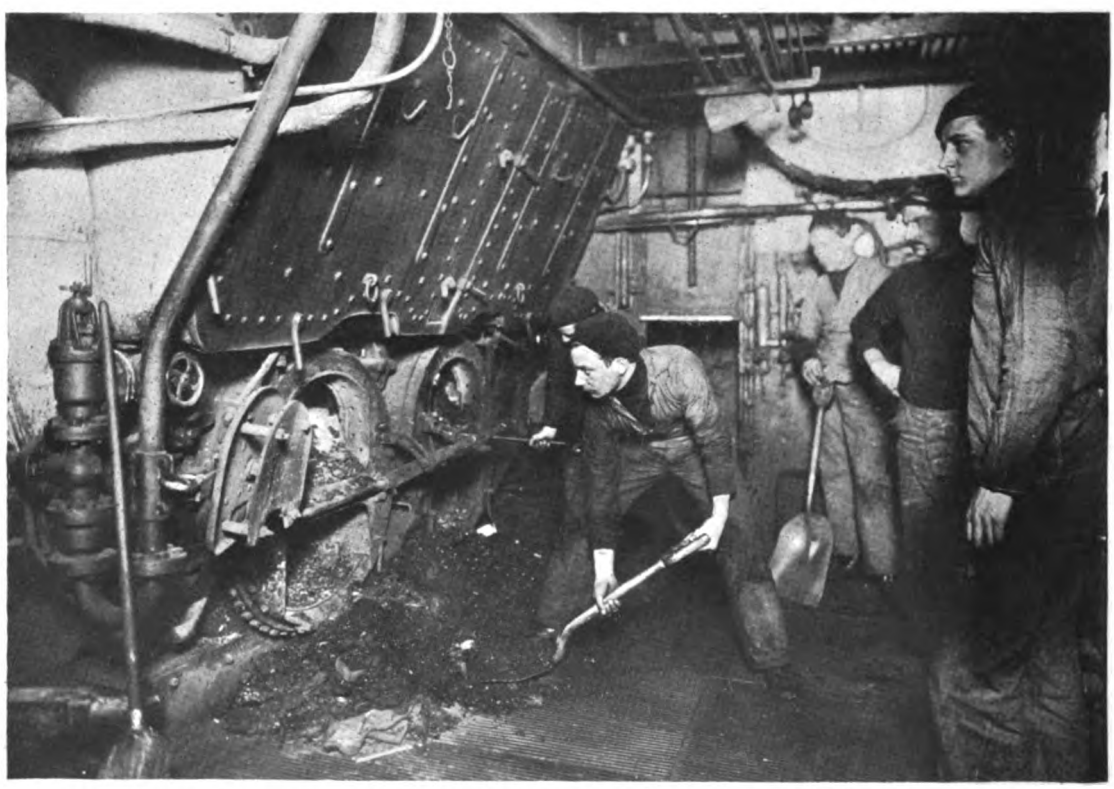

Fig. 3.—Cadets Specializing in Engineering Get Actual Experience in Firing and Handling the Machinery

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Fig. 4.—Officers and Instructors on S. S. *Newport*

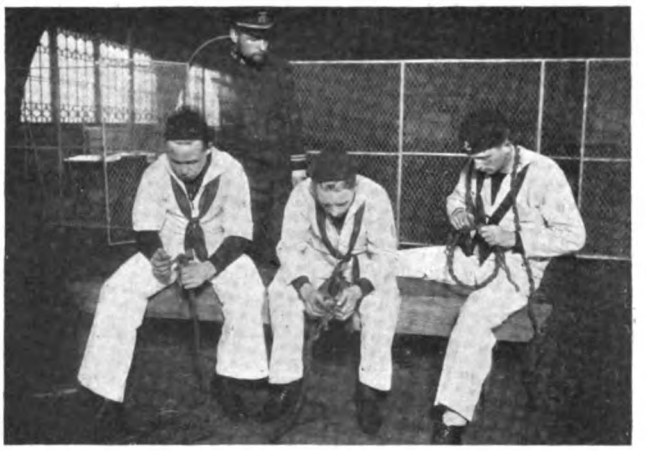

Fig. 7.—Knots and Splicing

for the establishment of schoolships, and it is hoped that all maritime States in the country will soon follow suit.

The New York State training ship is the *Newport*. This vessel is now fitting out at the New York Navy Yard as a patrol boat. For many years the home of the New York Nautical School was the *St. Mary*, which was maintained by the city of New York and under the direction of its Board of Education. More recently the *Newport* has been provided by the Navy Department, and since 1913 the schoolship has been under the direct jurisdiction of the State. Over 2,000 American boys have taken the two-year course on board the New York schoolship and have gone out to serve in the naval auxiliary or lighthouse department, or to command coastwise and ocean-going vessels. Such is the demand for graduates from this school that for the last two years 99 percent of the graduating classes were under pay and at sea two weeks after the close of the school year.

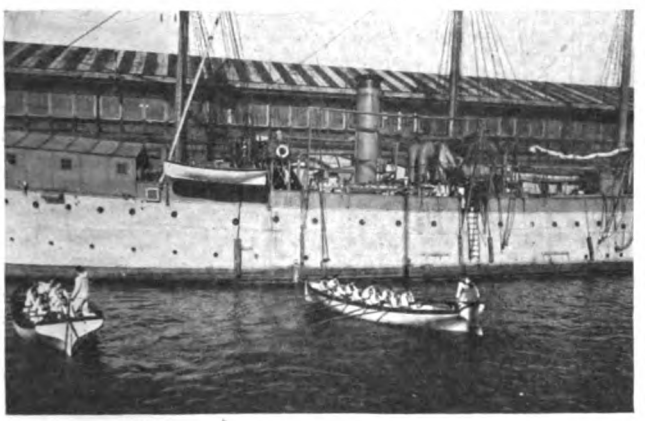

Fig. 5.—Boat Drill

In peace times, during the summer months, the students are taken on a long cruise on board the *Newport*, but during the winter the boat lies off the recreation pier at the foot of East Twenty-fourth street, New York. Much of the class work is done in the rooms on the pier. In addition there are many hours of practical work aboard the *Newport*, where the students are trained in every detail from shoveling coal to using the sextant. The course is a thorough one in the essentials of seamanship, navigation and marine engineering.

The cadets and instructors live aboard the ship under navy discipline. During their first year all the boys are required to do deck duty in the actual handling of the ship. They can then decide whether in their second year they will specialize in navigation or engineering. The ship's petty officers are selected from the honor students and in every branch of the work the boys get actual experience, thoroughly fitting them for the duties of officers in the merchant marine service.

Fig. 6.—Mess

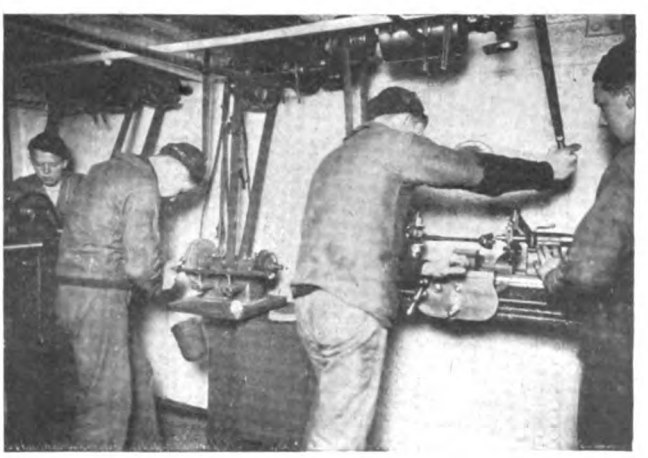

Fig. 8.—Machine Work

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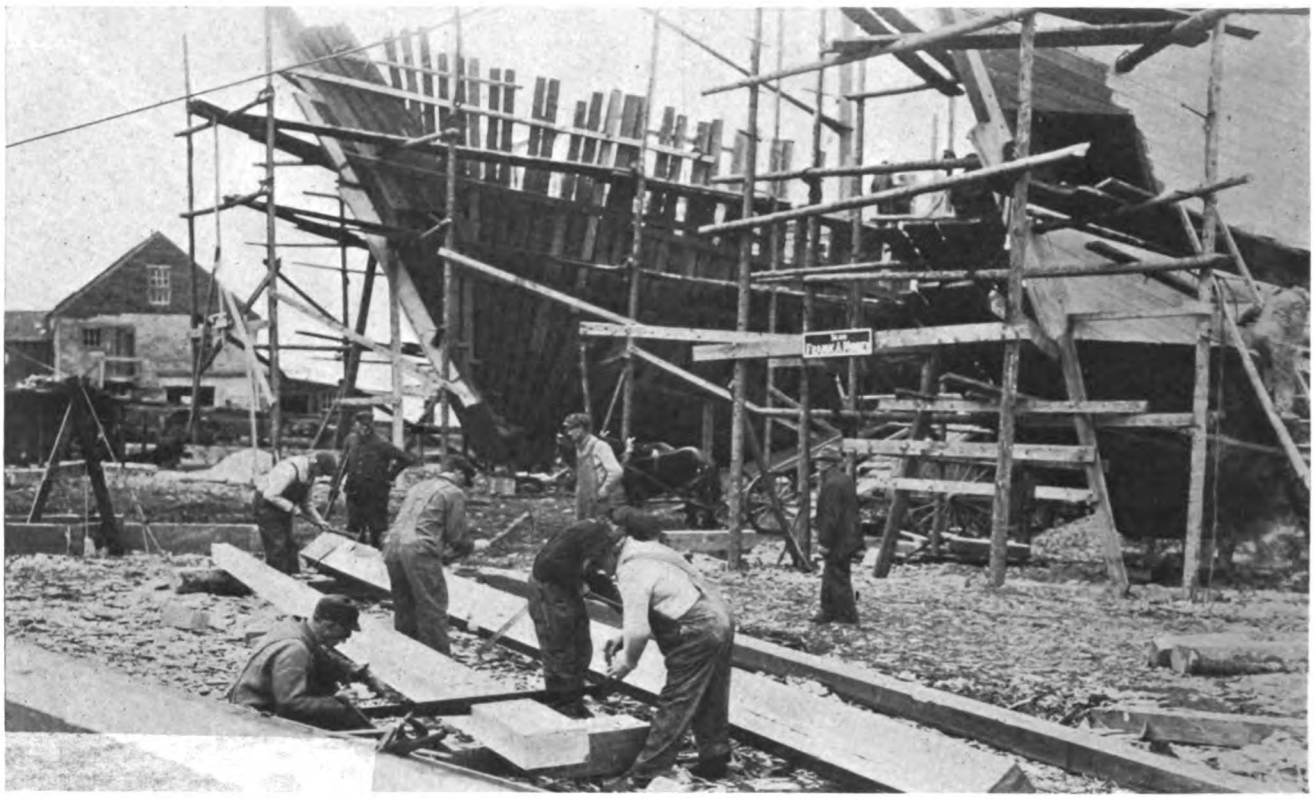
WOODEN SHIPBUILDING COMING INTO ITS OWN—OLD-TIME SHIPWRIGHTS AGAIN AT WORK



Old Time Shipbuilders Hewing Out Ship Timbers With Their Adzes

Wooden Schooner in Frame. Fitting the Keelson

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Letters from Marine Engineers

Discussion of the Design and Handling of Marine Engines, Boilers and Auxiliaries—Breakdowns at Sea and Repairs

This department is open to all readers of the magazine for the discussion of affairs in the engine room. All letters published are paid for at regular rates. Your ideas or experiences will be mutually helpful and interesting to other engineers. Write your letter now.

Education

Engineers are insistently urged by many articles appearing in our trade journals to start early in their careers and obtain a broad and thorough grounding in the fundamental principles, in order that they may apply them to the practical solution of problems in engineering, such as furnace efficiency, thermodynamics, electricity, etc. More than this, they are expected to attain such ability and expediency as will be required to keep the boilers, engines and machinery of the ship in almost continuous service, with the highest possible score of economy.

Have you ever stopped to think of the unremitting, diligent study and labor these things require of an engineer, not for just a few years, but for as long as he may hope to qualify as a competent up-to-date engineer? This asks not just only the regular performance of ship's duties, but requires a large part of his personal time and money; money for membership to engineering societies, purchase of text books, instruments, and small tools, subscriptions to trade journals, personal time for attending lectures, visits to other ships' plants, and careful study of the books and periodicals devoted to the engineering field.

Many of our marine engineers have struggled up through all this arduous schooling and then have concluded that their qualifications and abilities are for naught. By this the writer means that their hands were tied by men in authority, such as corporation directors or others in the steamship establishment running the line of ships, who do not show any interest in the engineer department of a vessel, other than the thought that it is a necessary evil to run the ship. By tying of an engineer's hands the writer means that when the engineer makes a report on poor coal, or suggests the adoption of some new piece of machinery or instrument that he has carefully studied and knows that it will benefit the ship's efficiency, these things are either ignored or discouraged. Antiquated and inefficient machinery is nursed along, and when a raise is suggested for the fireman or others he is told that they are getting all they're worth, or some such excuse. It is, indeed, unfortunate that an engineer accepts any such a position, but circumstances are such at times that, in order to live, many do.

Therefore, it seems to the writer that a great deal of the educational work relative to the engineer department of a vessel is too one-sided, and that the superintendent or general manager of a line of ships should be urged to learn a bit more of the engineer department of his ships, or give the engineers more consideration of their problems.

It is my opinion that a manager or superintendent should possess an intelligent understanding of the requirements of the engineer's department of a vessel in sufficient degree to realize the necessity of proper equipment for economical operating; that he should be able to judge the ability of his engineers. Should he not be so qualified, then the engineer should be given full sway in all matters relating to the upkeep and running of his department.

I do not write this in hope that it will cause managers and superintendents to change their stand towards their operating engineers, but rather in hope that it will draw attention to the true cause as to why some ships' engineer departments are so dilapidated and wretched, in spite of a really intelligent engineer in charge. It is too easy to blame the ship's chief engineer for the poor conditions apparent, and without any thought of where the real blame lies.

When the high-up boss does not show any particular interest in the results of the engineer department of the vessel, it is foolish to expect enthusiasm from those serving under him.

ENGINEER.

"On Watch"

The article entitled "On Watch," by "Progressive Engineer," page 231 of the May, 1917, issue, is interesting. It is not strange to say that years ago, when I was a watch engineer at sea, the same thoughts occurred to me as referred to by your correspondent. Men are much the same all the world over, and at all times; so we frequently find others who think the same thoughts that we have thought, although at a different time and place. It is a sort of a "history repeating itself" idea, and probably will endure as long as man lasts. "Progressive Engineer" gives some very good suggestions, particularly to the younger set of engineers now in the making.

Now, just a few lines about engineers' catechisms to which the correspondent alludes in his letter. The question and answer, or catechetical, method of obtaining information should be thoroughly understood before it is adopted. Undoubtedly the catechism has its place in the technical literature of the day.

There are times when it comes in very "handy," as we say, and it frequently contains just the thing in particular that we want; but a catechism must be used intelligently, else it may perhaps prove a "delusion and a snare."

To the man who has a good knowledge of the fundamental principles of engineering and all that that involves, a good catechism on any engineering subject will prove of value to him, and very often be very convenient to refer to for some point in particular; but to the man who is seeking information of an elementary nature—a beginner—the catechism is not at all suitable or satisfying. Committing questions and answers to memory, as some learners attempt to do, is not any good. The catechism presupposes a good basic knowledge of elements and principles on the part of the reader, for then he will clearly see the application of the question and its answer as contained in the book.

The purpose of an examination of any kind is to discover how much or how little the candidate really knows of his subject, and it is not simply for the purpose of having a given number of questions answered, as so many persons seem to think. If a man knows his business he will be able to stand a fair examination, without committing to memory a set of questions and answers. If he does not know what he professes to know, then by the use of questions it will be discovered by the examiner.

Coaching and cramming for an examination, via the

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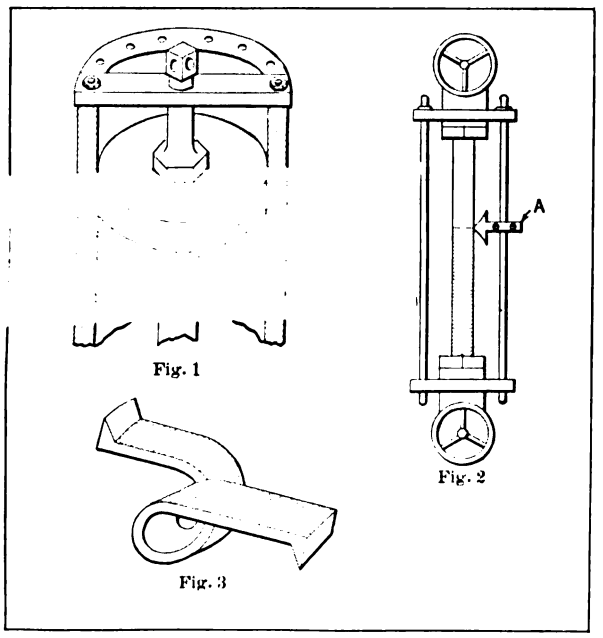
catechism, may pull a man through, but later he himself "finds himself" and learns of his shortcomings and weaknesses. A man who studies only a catechism forms erroneous ideas of some of the things he reads about, and must at some time "unlearn" them, and begin all over. Why not, then, begin right? Study the fundamentals first, and use the catechism last. We still want the catechism, just as we need the Question and Answer Department in this journal, but we must first learn *how* to use them, and profit by them.

Scranton, Pa. CHARLES J. MASON.

Kinks

Fig. 1 shows a support that will be found quite handy for steadying the socket wrench when loosening a stubborn piston rod nut, or for rigidness when driving the nut on for keeps.

Fig. 2 shows a brass clip at A fastened to the guard rod, which serves as an indicator of the last reading of the oil



Handy Kinks

level in fuel oil storage or settling tank. The rule for the operation of gage glass columns is to keep the valves closed, except when a reading is wanted. This indicator will always show the last reading.

Fig. 3 shows a tube scraper for 4-inch tubes made from an old file, which is secured to a 1-inch rod and revolved when being pushed through the tube.

HANDY.

Inspect the Feed Pipe

Recently the engineer of a transatlantic cargo vessel, fitted with Babcock & Wilcox boilers, related to me an experience that he had down below decks which came near costing the loss of his ship while coming home in ballast. Here is the story as told to me by the chief:

A submarine was sighted one day out of port, and immediately a call for full speed was given. All boilers were under steam at the time, four being light spread fires and the other four being worked. At the emergency signal things started to hum in the fire rooms. Everything was closed up for forced draft; the light spread fires were quickly built up and in ten minutes the old engines were pounding out 16 knots. Then trouble started. The water tender came tearing at breakneck speed into the engine room, yelling: "Speed up the feed pumps. We're losing the water in the forward boilers! The checks and stops are open wide, but we can't keep the water from dropping."

I jumped to the feed pumps, opened them up wide at the throttles, and then ran to the fire room just in time to see the water leaving the bottom of the glass in the two forward boilers. I immediately gave orders to check the fires of both of these and to handle the engines according to the steam.

In a few minutes the water was back to normal level in these two boilers; then we opened the dampers again, once more started working the fires, and speeded up the engines —then the same thing happened all over again.

The speed was again reduced, the two forward boilers were checked up and their water level regained, and when not forcing them we were able to keep the water at the normal level. I knew now that the trouble was somewhere in the feed piping of these two boilers. By forcing the other six and working these two as much as possible without undue risk, we managed to pull through, keeping up a zigzag course at top speed of 16 knots for eight hours.

Under normal steaming conditions we had never experienced any trouble feeding these boilers. As soon as we were safely out of reach of submarines on this side of the Atlantic I tackled the job of looking for the cause of the trouble. I had a feeling that there was something wrong with the feed checks or stops, that they, perhaps, would not open wide. But after inspecting these, they were found in good condition. I then opened up the drums, took out the internal feed line, and here we found the cause of our trouble.

The pipes were more than half plugged with grease, sediment, small pieces of rubber valves and grit. This foreign matter had gradually accumulated until it had so filled the pipe that the discharge area was reduced. The boilers, when forced, evaporated more water per second than the reduced feed line opening could supply.

This lesson, taught by experience, will never be forgotten. The story is worth handing on to other fellows. It shows the need of inspecting the internal feed pipes more often.

C. H. W.

Prepare for the Future

Prepare for the future—begin to right now!
Make the most of yourself—that should be your vow.
Focus your will power on getting ahead;
Use good sense and foresight, have faith, and don't dread
To meet opposition—of that you are sure:
The position you wish is to others a lure.

Remember the impulse to get ahead spurs
On endeavors the best, self fits you, and blurs
That feeling of failure and thinking you'll quit:
It's your attitude mental that makes you quite fit.
Advance surely each year—have patience—don't fret:
In time the reward you have worked for you'll get.

To know you are mastering difficult things
Makes the struggle a pleasure, and strength to you brings.
To meet every obstacle right now prepare!
Don't ever give up! Go ahead! You'll get there!
There's a chance waits for you—have courage—start in
And fully prepare—then success you will win.

Concord, N. H. C. H. WILLEY.

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Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding will be Answered in this Department

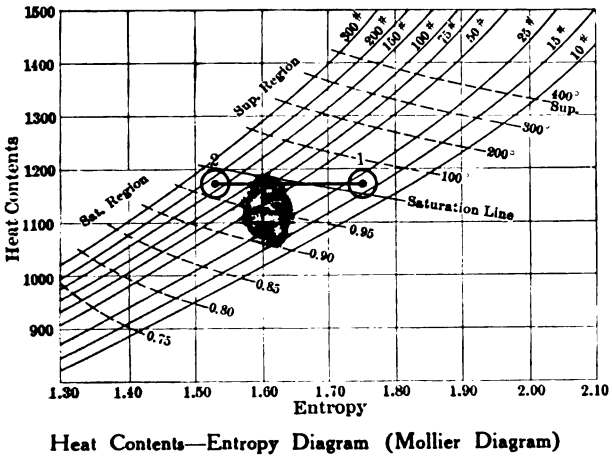
BY H. A. EVERETT*

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so. Indicator cards taken from marine engines will be carefully analyzed, the defects pointed out and the horsepower calculated, provided complete data are sent with cards.

How to Work Up Data from Peabody Throttling Calorimeter

Q. (884).—Will you please show me the easiest way to work up the following observations taken on a throttling calorimeter of the Peabody type: Steam line pressure, 165.8 pounds gage; chamber pressure, 5.3 pounds gage; chamber temperature, 253 degrees F.

A. (884).—The simplest way is to use the Heat Contents-Entropy Diagram, commonly called the Mollier Diagram. The absolute pressures assuming 14.7 pounds to be the atmospheric pressure, are 165.3 pounds + 14.7 pounds = 180 pounds in the line, and 5.3 pounds + 14.7 pounds = 20 pounds in the chamber. The temperature corresponding to 20 pounds is 228 degrees F., therefore the superheat in the chamber of the calorimeter is 253 degrees — 228 degrees = 25 degrees. With the *pressure* and *superheat* as arguments, enter the diagram and we land on a heat contents of 1,168. As the change has been at constant heat contents, follow this heat contents line over till we reach the line pressure of 180 pounds. The quality is then read directly as .978



Heat Contents—Entropy Diagram (Mollier Diagram)

NOTE.—Peabody's diagram used. See figure, find position No. 1, then go to position No. 2 and read quality directly.

Steam Consumption of Marine Pumps

Q. (893).—What is a good average value for the steam consumption of marine pumps and how is the power necessary determined in a design?

A. (893).—It is very large, as they usually take steam full stroke, thus having no expansion and an abnormal amount of cylinder condensation. It is common practice to allow 120 pounds of steam per brake horsepower per hour for boiler feed pumps running at a constant or nearly constant rate and to allow 200 to 300 pounds per brake horsepower per hour, if the unit is started and stopped frequently, the increase in the second case coming from the condensation in the steam line to the throttle.

To find the work of a pump, multiply the pounds of water fed by the head (feet) equivalent of the pressure against which it is to operate and increase by about 50 percent to allow for slippage, friction, etc.

NOTE.—One pound per square inch = 2.5 feet of water, approximately.

Efficiency of Steam Engine

Q. (891)—Why does the steam engine in actual operation not conform to the theoretical or ideal engine or one whose efficiency is 100 percent?

A. (891).—The question is important and its answer needs to be prefaced by a brief statement as to just what we mean by efficiency. Roughly, we may say that efficiency is the ratio of

$$\frac{\text{output}}{\text{input}}, \text{ or } \frac{\text{work done}}{\text{energy supplied}},$$

or for an engine which transforms heat into work, as a steam engine,

$$\frac{\text{the work done}}{\text{the heat energy supplied}}$$

Oftentimes we are not so much interested in this fundamental efficiency (called thermal efficiency) as in the percentage by which an actual unit approaches an ideal unit which transforms all the energy *available between its working limits* of temperature into work; this is variously called the efficiency of performance, cylinder efficiency and commercial efficiency. To illustrate: If a boiler supplies steam to an engine at 150 pounds pressure (absolute) and the engine discharges to a condenser at 28 inches vacuum, all that goes to the condenser is wasted as far as the engine is concerned. This is a large portion (72 percent) of the total heat energy which was brought into the engine at the throttle and exists even if the engine has transformed the difference between supply and exhaust entirely into work. This *waste* is decreased by lowering the exhaust temperature or increasing the admission temperature, consequently the percentage of the energy available in this range to the total heat energy (reckoned clear down to absolute zero) that was brought in with the steam, called the thermal efficiency, is increased.

For this case the thermal efficiency (Rankine cycle) is 28.2 percent and in general ranges from 15 percent to 30 percent.

If we are willing to neglect this conception and simply say that our definition of efficiency shall be the ratio of the work which the actual engine produces to the work which an engine *working between the same temperature limits* would produce if it transformed all of the heat energy available between those limits into work, then we have the second sort of efficiency mentioned above, or "commercial efficiency"; this in practice ranges from about 40 percent

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to 75 percent, and the principal sources of loss are as follows:

Condensation of steam on cylinder walls.
Leakage and radiation.
Friction.

Reactions of Propeller Shafting at Strut Bearings

Q. (877).—In attempting to derive a design factor for the strut bearings of propeller shafting I have needed the reactions at these bearings. I believe these can be estimated by the methods applied to the solution of continuous girders, but have had difficulty in the solution, as the reactions so found do not sum up to the total loads. I enclose a sketch of a specific case, and should greatly appreciate it if you would determine the reactions at the bearings numbered 1, 2 and 3. I have considered the shaft cut off short at 10 feet forward of bearing number 3, which is not the case, but I know of no better assumption, and some one was necessary, which would shorten up the computation.

A. (877).—An exact solution of this problem could be obtained for any number of spans and any loading, by applying the "three moment equation" to each two consecutive spans and solving the system of simultaneous equations thus found. If we can reasonably approximate the moment at the third support, the shaft forward of it

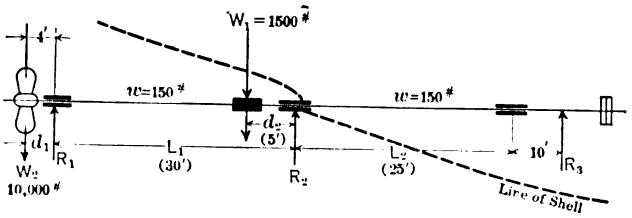

Fig. 1

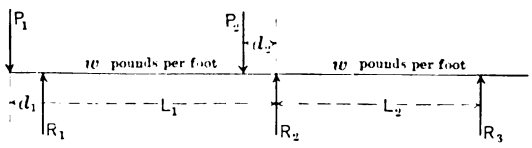

Fig. 2

may be neglected. We may then apply the three moment equation to the first two spans and solve for the moment at the second support, as all other quantities in the equation will be known. Then will thus result the moments at the first three supports, which in turn permit the finding of these reactions.

For uniform loading $\frac{-wL^2}{12}$ is a practical value for the moment at the third support of a beam of any number of spans greater than three, as may be seen by a comparison of the exact values calculated for beams of four, five, six and seven spans. The weight per foot of shaft is w, and L is the length of one span in feet.

Now considering the concentrated loads, we find from exact analysis that for the case of loads to the left of R_2, the moment at the third support will be practically one-sixteenth of the known moment at the first support. This will not be correct, if there are concentrated loads in the other spans, although if there are loads several spans to the right of the third support, this result will not be materially altered. The part of the uniform load to the left of the first support may be considered as part of the concentrated loading, and this has been done in the following solution, which accords with the preceding assumptions.

Let M_1, M_2, M_3 be the moments at the supports 1, 2, 3 respectively, and R_1, R_2, R_3 the corresponding reactions. Now

$$M_1 = -P_1d_1 - \frac{wd_1^2}{2}, \text{ and } M_3 = \frac{M_1}{16} - \frac{wL_2^2}{12},$$

according to the previous assumptions.

Applying the "three moment equation" to the spans L_1 and L_2, we have:

$$L_1M_1 + 2(L_1 + L_2)\,M_2 + L_2M_3 + 2L_1P_2d_2 - 3P_2d_2^2 + \frac{P_2}{L_1}d_2^3 + \frac{w}{4}(L_1^3 + L_2^3) = O.$$

In this case

$$M_1 = -10000\,(4) - \frac{150\,(16)}{2} = -41{,}200 \text{ foot pounds.}$$

$$M_3 = -\frac{41200}{16} - \frac{150\,(625)}{12} = -10{,}400 \text{ foot pounds.}$$

Hence,

$$-41200\,(30) + 2\,(55)\,M_2 - 25\,(10400) + 2\,(30)\,(1500)\,(5) - 3\,(1500)\,(25) + \frac{1500\,(125)}{30} + \frac{150\,(27000) + (15625)}{4} = O.$$

And

$$M_2 = -\frac{446{,}200}{110} = -4{,}050 \text{ foot pounds.}$$

Taking moments of the forces to the left of the second support, we have:

$$M_2 = -P_1\,(L_1 + d_1) + R_1L_1 - P_2d_2 - \frac{w\,(L_1 + d_1)^2}{2},$$

or

$$-4050 = -10000\,(34) + 30\,R_1 - 1500\,(5) - \frac{150\,(1156)}{2},$$

whence,

$$R_1 = \frac{430{,}150}{30} = 14{,}340 \text{ pounds.}$$

In like manner, taking moments about the third support:

$$M_3 = -P_1\,(L_2 + L_1 + d_1) + R_1\,(L_2 + L_1) - P_2\,(L_2 + d_2) + R_2L_2 - \frac{w\,(L_2 + L_1 + d_1)^2}{2},$$

or

$$-10400 = -10000\,(59) + 14340\,(55) - 1500\,(30) + R_2\,(25) - \frac{150\,(3481)}{2},$$

whence,

$$R_2 = \frac{97000}{25} = 3{,}880 \text{ pounds.}$$

Now R_3 will not be equal to the sum of the loads minus $(R_1 + R_2)$, since we have assumed the beam to continue indefinitely to the right of the third support, and by so doing have not assumed sufficient data to calculate it exactly, but with fair approximation it may be computed in that way, so that

$$R_3 = (21850 - 18220)\ 1.10 = 3{,}993 \text{ pounds.}$$

An exact analysis of a five-span beam, the first two spans being as shown above, and the remaining spans each 25 feet long and subject to the same uniform loading, gives the value of

$R_1 = 14{,}370$ pounds, and $R_2 = 3{,}870$ pounds, $R_3 = 4{,}080$ pounds.

It should be borne in mind that the flexibility of the ship's hull and the varying thrust of the crank can inject effects which may preponderate over the simple reactions computed as above.

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Shipyard Mechanics Urgently Needed at Philadelphia Navy Yard

The following list of mechanics and artisans urgently needed at the League Island Navy Yard, Philadelphia, gives an excellent line on wages now offered by the Government for certain classes of workers: Nine boatbuilders, at $3.04 to $4 a day; five riggers, at $2.88 to $3.76 a day; five riggers' helpers, at $2 to $2.48 a day; twelve shipfitters, at $4.24 a day; fourteen shipwrights, at $3.04 to $4 a day; fifteen drillers, at $3.04 a day; twenty coppersmiths, at $3.28 to $4.24 a day; twenty coppersmiths' helpers, at $2 to $2.48 a day; ten laborers, at $1.76 to $2.24 a day; twenty-one painters, at $2.80 to $3.60 a day; fifty painters' helpers, at $2 to $2.48 a day; boiler makers, at $3.28 to $4.24 a day, and boiler makers' helpers, at $2 to $2.48 a day.

Urgent Need of Ships for Coast Defense

The Navy Department has urged upon the consideration of the House Committee on Naval Affairs its urgent need for ships for the coast defense fleet, and has suggested legislation to enable the Department to commandeer those it requires at a reasonable price.

A number of the finest yachts in the country have been tendered to the Government by the owners for use during the war, either free or on a nominal lease, and numerous vessels of other types, including smaller boats, have been bought or leased; but a great many more are needed.

The owners of a number of the vessels that are sought by the navy are asking exorbitant prices for them. About 200 yacht owners have refused to sell their vessels to the Government at prices to be fixed by the Board of Appraisal, and several have refused to sell at any price.

The Navy Department has inspected approximately 600 privately-owned vessels. Of these approximately 500 have been found suitable. The owners of 192 have entered into agreement to turn their boats over upon notification and have been so notified.

Owners of most of the tugs and fishing boats suitable for this work absolutely refused to consider either lease or purchase; others asked outrageous prices. As an example, a fishing vessel was appraised for $30,000; the owner would not sell for less than $112,000. The $30,000 was more than the cost of the vessel.

Shipbuilding Contracts

The Superior Shipbuilding Company, Superior, Wis., a branch of the American Shipbuilding Company, Cleveland, Ohio, has received a contract to build 18 steel steamships. Ten of these will be 263 feet long, with a gross tonnage of 2,500, and the other eight are to be trawlers.

John M. Dullahan, Orange, Tex., and A. R. Daugherty, New York, are stated to have received contracts to build seven steel steamships at Orange. The Terry & Tench Construction Company, Grand Central Terminal, New York, is in charge of the construction.

It is reported that J. V. Paterson, formerly president of the Seattle Construction & Dry Dock Company, has received contracts to build six submarines for the Russian Government. It is reported that these submarines are to be built at Vancouver, B. C.

The Merrill-Stevens Company, Jacksonville, Fla., has received contracts to build four 5000-ton steel vessels and is taking steps to enlarge the plant to provide facilities for building them.

It is stated that the Ames Shipbuilding & Dry Dock Company, Seattle, Wash., has a contract to build fifteen steel steamships, ranging from 8,500 to 9,000 tons each.

The Tampa Shipbuilding & Engineering Company, Tampa, Fla., has received a contract to build two 3,500-ton steel vessels.

W. L. Henderson, president of the Henderson Iron Works, Mobile, Ala., is said to have closed contracts to build several vessels for the Government.

Salmen Bros., Slidell, La., are building a freight steamship for Norwegian owners.

McGuckens & Hyer, Tampa, Fla.; F. H. McConnell, Jacksonville, Fla., and W. T. Wells, Arcadia, Fla., are reported to have received contracts to build six wooden ships.

The National Shipbuilding Company, Puget Sound, Wash., has received a contract to build two 3,500-ton wooden freight ships.

Henry Piaggio, Gulfport, Miss., is building five 301-foot auxiliary schooners in his yards at Orange and Beaumont, Tex.

The Orange Maritime Corporation, Beaumont, Tex., has received a contract to build a 1,000-ton wooden schooner.

Ernest Jahncke, New Orleans, La., is said to have secured a contract to build six wooden ships.

E. James Tull, Pocomoke City, Md., has received a contract to build four barges for the Diamond Point Boat Line, Philadelphia, Pa.

J. F. Duthie & Company, Seattle, Wash., have received a contract from the Cunard Steamship Company, New York office, 24 State street, to build three 8,800-ton steel steamships.

It is reported that the Baltimore Dry Docks & Shipbuilding Company has received a contract from the Garland Steamship Company to build a 340 foot steel freight steamship.

The Hind-Rolph Coal & Navigation Company, San Francisco, Cal., will build three wooden steamships and a five-masted barkentine at its new yard near Eureka, Cal.

The National Shipbuilding Company, Seattle, Wash., recently organized, is reported to have received contracts to build two 3,500-ton wooden ships.

The Hanlon Dry Dock & Shipbuilding Company, Oakland, Cal., is reported to have received contracts to build four more 7,000-ton steel freight ships.

The Western Shipbuilding Company, Tacoma, Wash., has received a contract to build an auxiliary schooner.

Shipyard News

The Potomac Shipbuilding Company, Orren G. Staples, Washington, D. C., president, has been organized and will build a yard at Quantico, Va. George C. Shepard, Baltimore, Md., is engineer and general manager.

According to reports a large steel shipbuilding plant is to be established in Baltimore, Md. Among those mentioned as active in organizing the project are Bernard N. Baker and E. M. Newton, both of Baltimore.

It is reported, on apparently good authority, that J. W. Thompson, a St. Louis contractor, has arranged for the establishment of a large shipbuilding plant at New Orleans, and it is stated that Mr. Thompson has received enough contracts from the Government to run the plant at full capacity for at least three years.

The Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md., will spend $2,000,000 in building a new plant. Day & Zimmerman, Philadelphia, Pa., have the plans in charge.

The Downey Shipbuilding Corporation, Wallace Downey, 120 Broadway, New York, president, has been incorporated, with a capital stock of $5,000,000. The new company is planning the erection of a shipbuilding plant for the construction of freighters at the steel works of Milliken Bros., Staten Island, N. Y.

The Pennsylvania Shipbuilding Company, Land Title building, Philadelphia, Pa., has increased its capital stock from $[illegible]00,000 to $1,000,000, in order to provide for expansion.

The Lone Star Shipbuilding Company, established at Beaumont, Tex., has now completed its organization. McBride & Law, Beaumont, are back of this project.

Stone & Webster, Boston, Mass., are reported to have secured 25 acres of water front at Seattle, Wash., with the anticipation of building a large number of wooden ships for the Government.

The Elco Company, Bayonne, N. J., manufacturer of motor boats, is making extensive additions to its plant.

The New London Shipbuilding Corporation has been organized in the State of Delaware, with a capital stock of $10,000,000. Samuel B. Howard, 28 Nassau street, New York, is one of the directors. It is understood that this company will build a shipyard at Groton, Conn.

The Maryland Shipbuilding Company, Baltimore, Md., with a capital stock of $1,000,000, has been organized by J. E. Aldred, of the Consolidated Gas, Electric & Power Company, Baltimore, and associates. The president of the company is Charles E. F. Clarke, president of the Pennsylvania Water & Power Company, Baltimore.

The Charleston Shipbuilding Company, Charleston, S. C., has been organized, with a capital stock of several million dollars. It is understood that Whittelsey & Whittelsey, 17 Battery Place, New York, have charge of the laying out of the plant, etc.

Henry Lysholm, Woodbury, N. J., and associates have incorporated the New Jersey Shipbuilding Company. Haakon E. Norbom, Germantown, Philadelphia, is one of those interested.

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Shipbuilding and General Marine News

Contracts for New Ships—Marine Terminal Improvements—Recent Launchings—Improved Appliances—Personal Items

The Navy Department has awarded contracts for twenty-four 1,000-ton mine sweepers to private shipbuilders who now have no Government work on hand. The contracts have been placed with the Standard Shipbuilding Company, New York; Staten Island Shipbuilding Company, New York; Harlan & Hollingsworth Corporation, Wilmington, Del.; Sun Shipbuilding Company, Chester, Pa.; Bethlehem Steel Company (Maryland plant), Sparrows Point, Md.; Chester Shipbuilding Company, Chester, Pa.; Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md.; Pennsylvania Shipbuilding Company, Gloucester, N. J.; Todd Shipbuilding Corporation, New York, and Pusey & Jones, Wilmington, Del.

The Navy Department has also awarded contracts for twenty-four submarines to the Electric Boat Company, New London, Conn.; four submarines to the Lake Torpedo Boat Company, Bridgeport, Conn., and ten submarines to the navy yard, Portsmouth, N. H.

Contracts for four additional torpedo boat destroyers have also been placed with the Newport News Shipbuilding & Dry Dock Company, Newport News, Va.

At the recent Big Waterways Congress at St. Louis, Mo., a movement was set on foot for the rehabilitation of water transportation on the Mississippi and its tributaries. Two barge corporations are to be formed, one with a capital stock of $2,000,000, to operate lines of boats and barges from St. Louis northward to the twin cities, and the other, with a capital stock of $1,500,000, to operate a similar service between St. Louis and New Orleans.

A naval base near Houston, Tex., comprising a navy yard, docks, naval training station, arsenals and ordnance factories, is proposed.

Wood-Working Machinery for Shipbuilding

Recent sales of woodworking machinery, according to the *Iron Age*, while largely increased over what they were a few weeks ago, have been for the most part to builders of submarine chasers, not to builders of wooden cargo boats under the Government plan. There is no close gage of just how much equipment will be taken for the latter work, and the fact that the Federal Shipping Board has not definitely decided on the original proposition of 1,000 wooden boats leaves the entire matter in an indefinite state.

It is evident from their contact with dealers that a great many prospective builders lack first-hand knowledge of shipyard work to an extent similar to some munition makers at the start of the war.

Some large yards are contemplated. One inquiry for locomotive cranes calls for sixteen cranes, one for each way, and ten additional cranes for service work about the plant. A moderate-sized yard, consisting of, say, three ways, is estimated to require about $20,000 worth of wood-working machinery and also metal-working tools.

Some prospective shipbuilders entertain the delusion that they can secure equipment immediately, by merely stating that they intend to build wooden ships. Others expect to get a Government order which will compel machinery dealers to hand over tools. Many fail to realize that other industries are equally vital and that equipment cannot be had immediately in most cases.

Manufacturers of wood-working machinery have no large stocks ahead, partly on account of the difficulty, now long existing, of getting materials. The larger plants are booked for two or three months ahead. An average delivery on this equipment is from 60 to 90 days. Large machines, which are the most needed in wooden shipbuilding work, are the hardest to get and require the most time to manufacture.

$25,000,000 Being Spent in Canada for Steel and Wooden Ships

Steel and wooden shipbuilding will be among the most important of Canadian industries in the near future. According to reports the British and Canadian Governments have already placed contracts for ships and shipyards totaling $25,000,000.

Among the many new Canadian enterprises is a shipbuilding plant, with a capital of $1,000,000, which is being organized in St. Johns, N. B. The International Shipbuilding Corporation has also recently been incorporated, with a capital stock of $2,000,000, with head offices in Montreal.

The Canada Steamship Lines Company is reported to be considering establishing a plant at Hamilton, Ont. The Canadian Shipbuilding Company will build a plant at Bridgeburg, and the National Shipbuilding Company will operate a plant at Goderich, Ont.

The Welland Shipbuilding Company, Ltd., St. Catherine, Ont., has been incorporated, with a capital stock of $200,000, by Francis H. Keefer, Donald Munro and others.

Mayor Gray, of New Westminster, B. C., is among those interested in the project of building a shipyard for the construction of wooden vessels.

Contracts for Submarine Chasers

The United States Navy Department, Washington, D. C., has given contracts to build 203 submarine chasers as follows:

		Each
Barrett Shipbuilding Co., Mobile, Ala.	4 at	$44,000.00
F. M. Blount, Pensacola, Fla.	4 at	45,000.00
Burger Boat Co., Manitowoc, Wis.	1 at	52,000.00
Chance Marine Construction Co., Annapolis, Md.	1 at	52,000.00
	2 at	49,000.00
Camden Anchor-Rockland Machine Co., Camden, Me.	2 at	51,000.00
Charles A. Dean, Alexandria, Va.	20 at	48,250.50
Dubuque Boat & Boiler Works, Dubuque, Ia.	2 at	52,000.00
The Elco Co., Bayonne, N. J.	16 at	50,000.00
Eastern Shipyard Co., Greenpoint, N. Y.	5 at	50,900.00
L. E. Fry & Co., Clayton, N. Y.	2 at	43,795.00
	2 at	42,000.00
Great Lakes Boat Building Corporation, Milwaukee, Wis.	2 at	52,000.00
Gibbs Gas Engine Co., Jacksonville, Fla.	3 at	44,500.00
	2 at	43,000.00
Hodgdon Bros., East Boothbay, Me.	1 at	37,500.00
	2 at	35,800.00
Hartman Greiling Co., Green Bay, Wis.	2 at	40,260.75
C. Hildebrandt Drydock Co., Kingston, N. Y.	15 at	44,540.00
International Shipbuilding & Marine Engine Co., New York	1 at	48,000.00
	9 at	46,000.00
Robert Jacob, City Island, N. Y.	5 at	52,000.00
Kyle & Prudy, City Island, N. Y.	5 at	52,000.00
George Lawley & Son Co., Boston, Mass.	20 at	52,000.00
Luders Marine Construction Co., Stamford, Conn.	5 at	52,000.00
Mathis Yacht Building Co., Camden, N. J.	5 at	49,200.00
	6 at	43,802.00
	4 at	42,892.00
Alex. McDonald, Mariners' Harbor, L. I., N. Y.	1 at	49,820.00
	3 at	49,320.00
The Newcomb Life Boat Co., Richmond, Va.	1 at	49,865.00
	4 at	48,565.00
The Matthews Co., Port Clinton, Ohio.	10 at	52,000.00
New York Yacht & Engine Co., Morris Heights, N. Y.	20 at	49,950.00
Rocky River Drydock Co., Rocky River, Ohio.	2 at	52,000.00
Smith & Williams Co., Salisbury, Md.	2 at	52,000.00
Vineyard Shipbuilding Co., Milford, Del.	2 at	42,300.00
	1 at	41,500.00
Howard E. Wheeler, Brooklyn, N. Y.	9 at	47,085.00
Total (203)		$9,768,059.50

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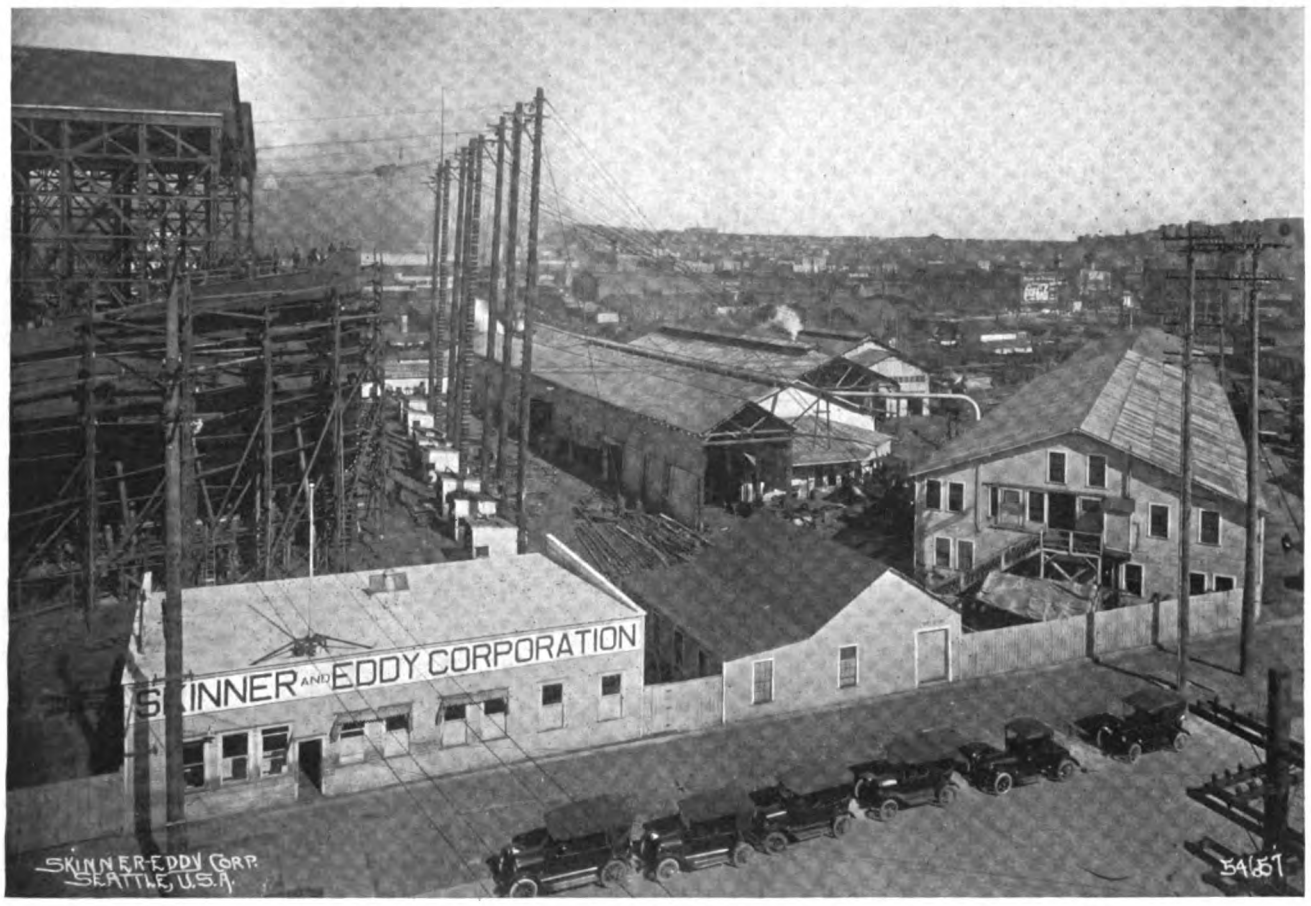

Shops and Forward End of Shipways at Skinner & Eddy Yard, Seattle, Wash.

The Biloxi Shipyard & Box Factory, Biloxi, Miss., has been incorporated, and it is reported will build submarine chasers for the Government.

The Phœnix Shipbuilding Company, New Orleans, La., has been incorporated, with an authorized capital of $2,000,000. The incorporators' names have not been announced.

The Seaboard Transportation & Shipping Company has been organized at Galveston, Tex. Henry J. Schutte is general manager and T. J. Anderson naval architect. The company is planning to build a marine railway, dry dock and general shipbuilding plant.

The Murnan Shipbuilding Corporation has been organized at Mobile, Ala., with a capital stock of $3,000,000. The president is Solomon F. Glens, Philadelphia, Pa.; vice-president, H. C. Murnan, Mobile, Ala.

The Skinner & Eddy Corporation, Seattle, Wash., will install new machinery as a result of receiving a contract to build a 9,500-ton steel oil tanker.

The Everett Shipbuilding Company, Everett, Wash., has been organized, with a capital of $100,000, to build wooden ships.

George W. Bush, San Diego, Cal., has acquired a tract of land at the foot of Beardsley street, for the purpose of erecting a shipbuilding plant.

Wilson Bros. Shipbuilding Company, Astoria, Ore., has been incorporated to take over the plant of Wilson Bros. The new corporation is planning to build three new ways and to install a full line of shipbuilding machinery.

The Anderson Shipbuilding Company, Seattle, Wash., has consolidated with D. H. Gray & Company and R. F. Guerin, under the name of the Anderson Shipbuilding Corporation. J. L. Anderson is president; L. H. Gray, vice-president, and R. F. Guerin, secretary. It is reported that work on the first of many 3,000-ton wooden ships will be begun at once.

Fred L. Baker, president of the Baker Iron Works, 950 North Broadway, Los Angeles, Cal., and associates are organizing a company to construct and operate a large shipbuilding plant. It is planned to spend several million dollars on the project.

H. L. Gastman and Arthur Leclear, Eureka, Cal., are planning to build a shipyard on Humboldt Bay.

The Gray's Harbor Motor Ship Corporation has started work on its shipbuilding plant in Aberdeen, Wash.

The Marine Iron Works, Seattle, Wash., has purchased a site and will establish a wooden shipbuilding plant. Sufficient contracts are said to have been already received to keep the plant busy for two years. Peter O. Peterson is president; A. M. McLain, vice-president, and Frederick H. Batton, secretary and treasurer.

The Seattle Machine Works, Seattle, Wash., is planning the immediate erection of a manufacturing plant to turn out heavy oil engines to meet the demands of the wooden shipbuilding industry. It is stated that engines from 75 to 300 horsepower will be constructed.

The Cavotto Shipbuilding Company, Seattle, Wash., has been incorporated and is planning to start work on a shipyard at an early date.

John H. Kirby, Houston, Tex., president of the Kirby Lumber Company, is organizing a corporation to construct a shipyard at Beaumont, Tex.

The International Shipbuilders have been incorporated, with headquarters at Seattle, Wash., by I. M. Howell, G. W. Ninmire, W. S. Bradley and others.

The Columbia River Shipbuilding Company, Vancouver, Wash., will soon begin work on the construction of a plant.

The Barrett Shipbuilding Company, Mobile, Ala., has been incorporated by George S. Leatherbury, J. T. Schley, W. R. Turner and others.

The Gray's Harbor Motor Ship Corporation has been incorporated, with headquarters in Seattle, Wash., by W. J. Paterson, A. Schybach, M. R. Ward and others.

The Everett Shipbuilding Company, Everett, Wash., has secured a site for the construction of a shipbuilding plant. D. W. Locke is president.

The Falketina Shipbuilding Company, San Francisco, Cal., has been incorporated, with a capital stock of $275,000, and will erect a plant on San Francisco Bay.

The Union Shipbuilding Company, Seattle, Wash., is planning the establishment of a shipbuilding plant at Lake Union for the construction of wooden vessels.

Charles N. Crowell, Galveston, Tex., is stated to be organizing a company to build a shipyard at Beaumont, Tex.

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The Tarver Shipbuilding Corporation has been incorporated, with a capital stock of $15,000, with headquarters at Beaumont, Tex.

The Sandstrom Shipbuilding Company, Seattle, Wash., has been incorporated to build a wooden shipbuilding plant. J. M. Farrell and Herman H. Sandstrom are among the incorporators.

The Raymond Shipyard Company, Raymond, Wash., has been incorporated by J. M. Frere, Wilmington, Del.; W. G. Shumway and C. B. Philbrick, of Raymond. It is stated that a site has already been secured.

The Marine Transportation Company, Mobile, Ala., has been incorporated by Peyton Norville, W. J. Norville and others to build submarine chasers.

The Anacortes Shipbuilding Company, Anacortes, Wash., is to be reorganized and enlarged.

The United Shipbuilding Corporation has been incorporated, with headquarters in Seattle, Wash., with a capital stock of $500,000. H. O. Guth and H. A. Bernardo are among the incorporators.

The Barrett Shipbuilding Company, Mobile, Ala., is planning to invest $300,000 in building a shipyard with the anticipation of securing Government contracts.

The Alabama Dry Dock & Shipbuilding Company, Mobile, Ala., is contemplating extensive improvements for the purpose of securing Government contracts.

The Los Angeles Shipbuilding & Dry Dock Company, Los Angeles, Cal., Samuel Naphalty, manager, has leased 70 acres of land and will soon begin the construction of its plant.

Eastman, Gardiner & Company, lumber manufacturers, Laurel, Miss., and Horace Turner, Mobile, Ala., are planning to build a shipyard at Mobile, Ala., with the anticipation of building ships for the Government.

Rolph Seeberg, Mobile, Ala., who is said to represent a syndicate of Norwegian capitalists, is planning to build a shipyard at Mobile.

The Wilson Shipbuilding Company, Astoria, Ore., has been incorporated, with a capital stock of $100,000, by J. P. Brix, Charles Wilson and others.

Capt. Varian C. Scott, Mobile, Ala., is reported to have purchased 20 acres of land, with the anticipation of erecting a shipyard to build Government vessels.

Sudden & Christensen, San Francisco, Cal., are reported to be planning the construction of a shipyard at Los Angeles.

Albert de Duiz, Long Beach, Cal., is negotiating for a site for the purpose of erecting a shipbuilding plant.

The Southern Dry Dock & Shipbuilding Company, Orange, Tex., has been organized, with a capital of $50,000, and is said to have already received a contract to build a four-masted schooner. S. M. White, of Orange, is president of the company.

The Old Dominion Marine Railway Corporation, Berkeley, Va., is planning to enlarge its plant, in order to provide for the wooden ships which the Government is ordering.

William E. Sehrs, Port Townsend, Wash., is planning the construction of a plant at Hadlock, Wash., for the construction of wooden vessels. It is stated that two contracts have already been received.

H. E. Heitman, Fort Meyers, Fla., is planning to build a shipyard, with the anticipation of securing Government contracts. The Fort Meyers Board of Trade is interested in the proposition.

Lincoln A. Gardiner and associates are reported to have purchased the old Crocker Shipyard, Stockton Springs, Me., and to have already secured a contract to build a four-masted schooner.

Charles F. Aulick and H. Coley Edwards, Tampa, Fla., are planning to establish a shipyard at Tampa, with the anticipation of securing Government contracts.

James G. Yates, Mayor of Port Tampa, Fla., has leased a site for a shipyard, in anticipation of receiving Government contracts.

The Bates-Hudnell-Jetton Company, Tampa, Fla., has secured a lease of land with the anticipation of securing Government contracts.

The Norfolk Shipbuilding & Dry Dock Corporation, Norfolk, Va., is constructing ways in anticipation of receiving Government contracts to build wooden ships.

The Florida Shipbuilding Company, Tampa, Fla., has been incorporated for the purpose of constructing wooden vessels. C. W. Deen, Lakeland, Fla., is president. J. M. Murdock, of Washington, D. C., is one of the directors.

T. M. Jones and A. B. McMullen, Tampa, Fla., are planning to organize shipyards for the purpose of securing Government contracts.

The Williams, Fair & Park Construction Company, R. M. Williams, manager, 154 West 131st street, New York, is planning to build a shipyard at Tampa, Fla., with the anticipation of securing Government contracts.

The Terminal Shipbuilding Company, San Francisco, Cal., has been organized, with a capital stock of $1,000,000, with the intention of building wooden vessels.

The Ward Shipyards, Olympia, Wash., are to be enlarged.

The Craig Shipbuilding Company, Long Beach, Cal., is to erect a frame machine shop on Channel No. 3.

The Brown Dry Dock Company, Morris street, Jersey City, N. J., has increased its capital from $50,000 to $100,000.

J. P. McDonough, head of the Galveston Dry Dock & Construction Company, says he will establish a shipyard on Pelican Island, and begin construction of seagoing vessels within the next 60 days. Another company may be formed to build the ships.

The Standard Shipbuilding Company, Vancouver, Wash., recently incorporated by W. C. McPherson, A. H. Devers, L. O. Elrod and Lloyd Bates, all of Portland, plans the immediate erection of a shipbuilding plant in Vancouver to construct wooden ships.

The Todd Shipyard Corporation have added to their New York plants the long-established Quintard Iron Works. The taking over of the Quintard Works was made necessary by the overflow of ship and engine repair work which now obtains. J. L. Lauder has been placed in charge of the offices of the added plant.

The Baltimore Dry Docks & Shipbuilding Company, Cross street, Baltimore, Md., has secured options on property at Spring Gardens, opposite its present plant at Locust Point, for a new shipbuilding plant as an extension to present works. The property consists of about 20 acres, with water frontage of about 600 feet. It is planned to build four new shipbuilding slips, with necessary shop facilities, to allow the construction of vessels about 600 feet in length and about 15,000 gross tonnage. A new drydock and floating dock are also contemplated, with railroad tunnel to connect the two plants. Day & Zimmerman, engineers, 611 Chestnut street, Philadelphia, Pa., have been retained to prepare preliminary plans. Holden A. Evans is president.

The Sunlight Building & Oil Company, Forty-ninth street and Gray's avenue, Philadelphia, is reported to have purchased a tract of about 200 acres of property on the Delaware River, Bristol, Pa., and plans for the erection of a large shipbuilding plant.

The Moran Towing & Transportation Company, 17 Battery Place, New York City, has acquired the property of the Southern Shipbuilding Company, formerly known as the Cole property, at Mill Creek, Staten Island, N. Y., at a price of about $50,000. The shipyard will be used by the Moran company for its scows, barges and dredgers, and it is said that a ship repair works will be constructed for company service.

The Southern Shipbuilding Company, Wilmington, Del., has been incorporated, with a capital of $10,000,000, to build a shipworks in Maryland. The Corporation Trust Company, Du Pont building, Wilmington, is agent for the organizers of the company.

During the past year the American Bridge Company has constructed six steel barges at its Trenton, N. J., works for the Lehigh Valley Railroad Company, the last having been launched a few weeks ago. The barges will be used as car floats in New York harbor; each is about 265 feet long and 40 feet wide, with weight of 600 tons, representing a cost close to $100,000. With the exception of the timber edges the entire barge is of steel. The local works are now operating at full capacity in the construction of ten additional barges of about the same size for the United States Government, Lehigh Valley and Pennsylvania Railroads. The largest of the boats will have a capacity of 24 freight cars. It is said that the company's business in this branch at the Trenton plant totaled over $600,000 during the last year.

Extensive Marine Terminal Improvements at Houston, Texas

The city of Houston, Tex., is spending over $900,000 on docks, wharves and other harbor improvements at Port Houston.

The city has just let contract for a modern concrete fireproof warehouse, 400 feet wide and 600 feet long, costing $150,000. Other improvements now under way are wharf No. 2, 504 feet long, 80,000 square feet, and wharf No. 3, 700 feet long, 24,000 square feet. These wharves will cost within the neighborhood of $189,224.

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Wharf No. 4 is nearing completion; it is 777 feet long, covering 901,000 cubic feet and 96,850 square feet; this includes the apron, platform and shed space, costing $296,696.

The city will shortly ask for bids on wharf No. 5, and will also let contracts for additional tracks connecting with their Municipal Belt Line, amounting to about $15,000.

Steamboat Inspectors Instructed to Co-operate with Shipping Board

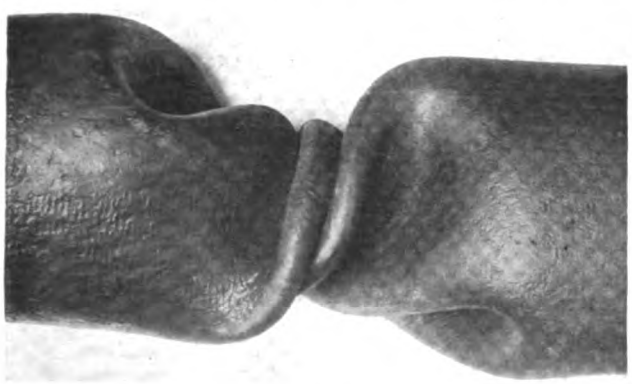
George Uhler, Supervising Inspector-General, Steamboat Inspection Service, of the Department of Commerce, has sent the following letter to United States supervising, local and assistant inspectors:

"As it is very probable that representatives of the United States Shipping Board will call upon you from time to time for assistance in connection with the prosecution of their duties with reference to shipping, you are directed, upon the receipt of such requests, to co-operate at once to the fullest extent with such representatives.

"You will bear in mind that at this critical time in the affairs of our Nation what is desired are results, and results must be obtained in every instance without delay, and the Bureau wishes to impress upon you that it desires the most hearty spirit of co-operation with the Shipping Board in connection with the great task that it has to perform."

Torsional Strength Test of 8-Inch National Pipe

In a test recently conducted by the National Tube Company, Pittsburg, Pa., a piece of 8-inch line pipe was subjected to a stress of 713,000 inch-pounds in torsion. The appearance



Section of 8-Inch National Pipe After Torsional Test

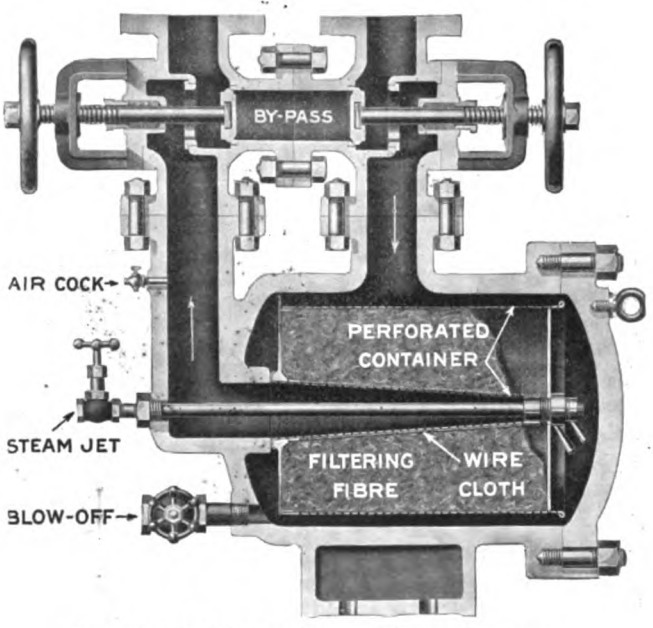
of the pipe, which weighs approximately 29 pounds per foot and has a wall thickness of about 1/3 inch, after being subjected to this strain, is clearly brought out in the accompanying illustration. The test specimen shows the homogeneity, ductility and high tensile strength of the steel.

R. & D. Feed Water Filter and Grease Extractor

The R. & D. filter, manufactured by Row & Davis, Engineers, Inc., 90 West street, New York, utilizes the affinity of coconut fiber for particles of oil, grease, scum and dirt, for the removal of these floating impurities from exhaust steam condensation and raw make-up water. Coconut fiber is peculiarly adapted to this work because of its high efficiency, low cost, suitability for re-use, and the fact that it is readily obtainable.

Referring to the illustration, the foul water enters the body of the filter, surrounds a cylindrical perforated metal container, percolates through the fiber (which retains the impurities), passes through a wire screen (which prevents escape of the fiber), and through perforations in a central conical tube which delivers into the outlet. The inlet and outlet valves are exactly alike, and so connected that the entire filter body may be removed without cutting off the boiler supply. The symmetrical construction of these valves and the location of inlet and outlet also permit of their valves being placed for insertion of the filter in a straight run of pipe, or if the feed pipe is located at an awkward point the line may be brought to a proper location for the filter by parallel inlet and outlet pipes.

A steam jet in the center of the outlet tube and a blow-off at the bottom of the filter body permit a temporary reversal of flow for steaming and washing out the worst impurities and for further efficient use of the fiber before its final removal for thorough cleaning. When the difference in pressure, as



R. & D. Feed Water Filter and Grease Extractor

shown on the gages on the filter body and the outlet, indicates that the fiber is clogged to an objectionable extent, a complete cleaning is effected by unbolting the filter cover, removing the container and inserting a charge of clean fiber.

To put the filter into operation, the air cock should be opened first; then the outer valve, which is farthest from the filter head, should be opened slowly to full opening; and then the inlet valve opened. The air cock should then be closed, and the difference in pressure between the inlet and outlet gages noted. After operation, until this pressure difference becomes 10 to 15 pounds greater than when the filter was first put into operation, the filter should be by-passed for steam cleaning. This is done by closing the inlet and outlet valves, opening the blow-off and turning on the steam jet for one to three minutes, which will boil out the grease and oil. This done, the steam jet should be turned off, the outlet valve slightly opened and the body washed out through the blow-out valve for about one minute. Closing the blow-out and opening the outlet and inlet, in the order named, put the filter into operation again.

Plate Planer for Edging Plates 40 feet Long and 1½ Inches Thick

The Covington Machine Company, Covington, Va., has recently built for the Standard Steel Car Company, Butler, Pa., a plate planing machine, for edging plates up to 40 feet long and 1½ inches thick. The machine weighs approximately 75,000 pounds. The frames are built with an open throat, so that plates longer than 40 feet may be planed by moving the plate forward. The machine is so designed that angles up to and including 8 inches by 8 inches of any length may be edged in the same manner as the plates by moving a section forward as soon as the first section is cut.

The drive screw, transmitting the power to the cutting head, is 48 feet long, 4 9/16 inches diameter, with a double lead Acme thread 1-inch pitch. The end thrust or reaction, due to the tool-cutting pressure, is cared for by two heavy ball bearings, one on each end of this screw, the arrangement of

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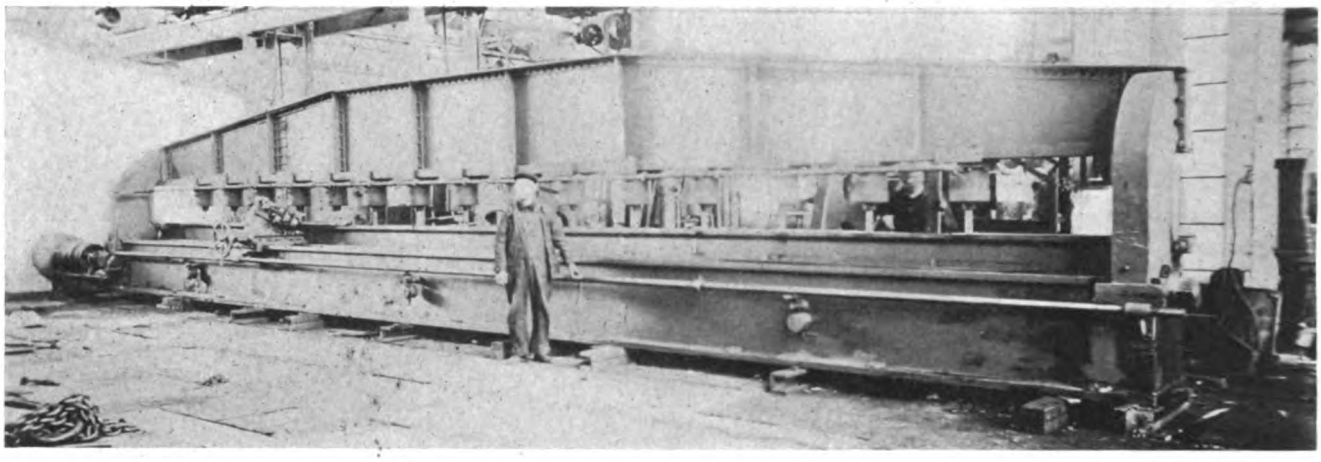

Fig. 1.—Covington Plate Planer, Designed for Edging Plates Up to 40 Feet Long and 1½ Inches Thick

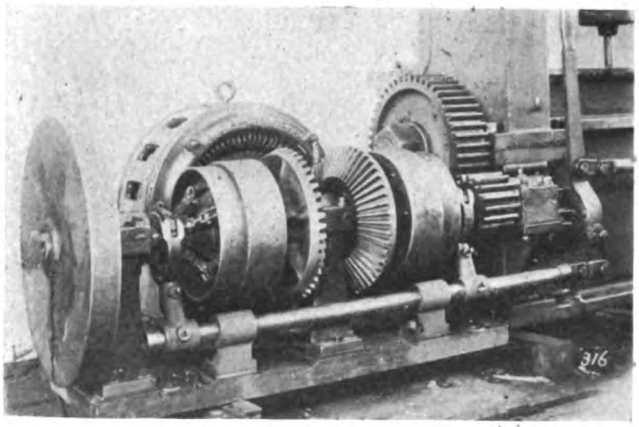

Fig. 2.—Motor Drive

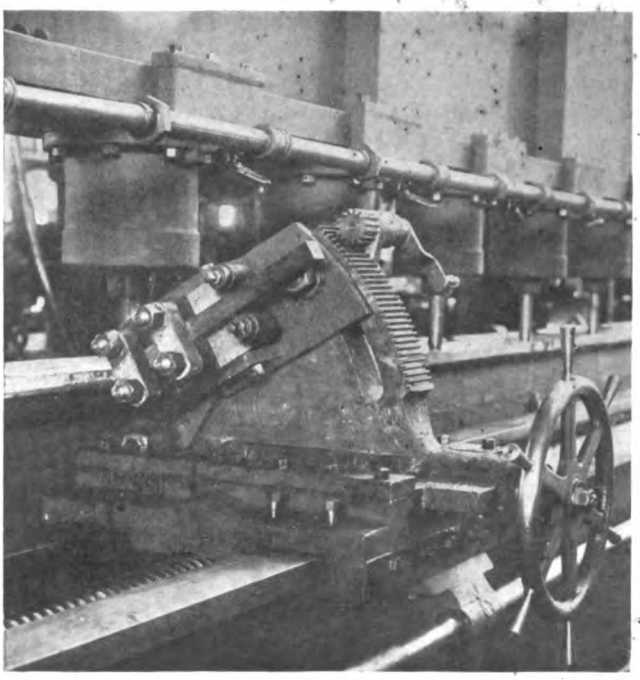

Fig. 3.—Cutting Head

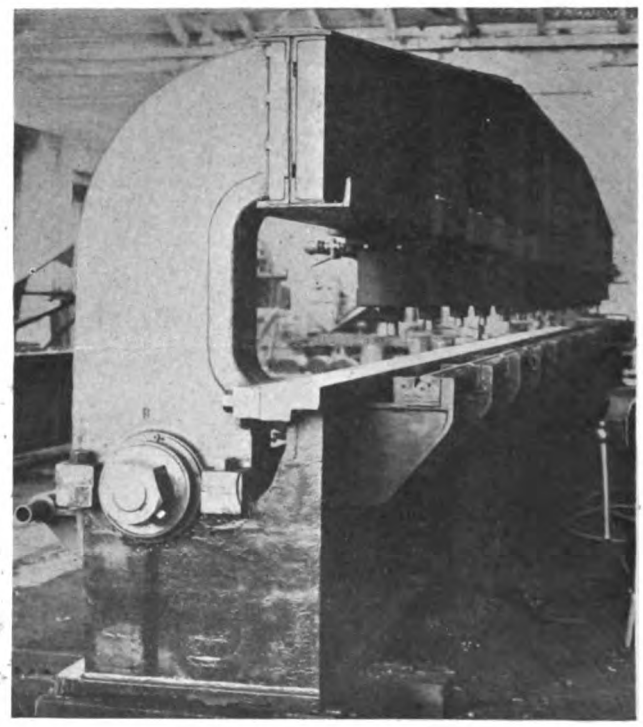

Fig. 4.—End View, Showing Open Throat Frames

the screw and thrust bearings being such that the screw is always in tension while carrying the cutting head. On the cutting head is mounted a bronze half-nut, engaging with the drive screw. The drive screw is supported for approximately one-third its circumference on the bottom its entire length. This support has extended flanges, forming a trough for flooding the screw with oil to insure lubrication at all times. At each end of the trough is a pocket for collecting the chips carried forward by the screw in its movement. Chips that are thrown out from the screw-bearing surfaces can be removed from the trough by hand or scraper while the machine is running or stationary. The end pockets are provided with large drain pipes so that the oil may be drained and filtered at any time. This also offers an opportunity for washing the screw and trough with cleansing oil, such as kerosene, at any time.

The cutting head consists of a steel casting mounted in cross feed guides on the carriage with two swivel aprons, one on each side of the cutting head. These aprons are pivoted upon a large pin bolt, which serves also as a clamp for holding the apron at any desired angle for cutting from 90 to 60 degrees. The tool holders are of the usual clapper box type on machine

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planers, and are large enough to take a tool 2½ inches wide by 2 inches thick and of any length.

The cutting speed is 20 feet per minute, the maximum cut for a 1¼-inch plate being 1/16-inch feed, although it was tested for 3/32-inch feed.

The machine is motor driven. Reversing the drive of the screw is accomplished by two multiple-plate friction clutches. On the motor shaft is mounted a bevel pinion, which miters into the two bevel gears, running these continuously. The clutches are arranged to grip these gears alternately, to give the motion in either direction as desired. The motion for reversing the screw through the clutches is taken from the carriage, and a flywheel on the end of the clutch shaft is provided for keeping the carriage in motion when one clutch is thrown out and until the other is thrown in. The flywheel further serves while cutting to maintain a uniform power on the cut.

The side of the plate which is to be edged rests on rollers and a table cast integral with the frame. The plate is clamped in position by fifteen pneumatic jacks, each exerting a pressure of 5,000 pounds on a basis of 80 pounds per square inch air pressure. The air cylinders are piped up so that all may be thrown simultaneously, or any single air jack can be thrown separately.

In designing this machine the parts and clearances were arranged properly to take care of shipyard requirements.

Rivet and Bolt Head Cutter

The Rivet Cutting Gun Company, 220 East Second street, Cincinnati, Ohio, after exhaustive tests, has put on the market a pneumatic tool for cutting off the heads of rivets and bolts, and which is also intended to back the rivets out. The manufacturer claims that about 75 percent in cost is saved over the hand method of using a cutting bar and sledge, and that by the use of a long cutting tool rivets and bolts can be reached that are located where a scaffold would be requirel when employing the ordinary hand method.

The machine is operated by three men where heavy and quick work is required. It consists of an elongated cylinder in which there is a piston mounted on slides. At the lower end of the cylinder a cup-shaped casting is provided that carries the cutting tool. The shank of the tool is passed through the casting and projects into the lower end of the cylinder. It is fitted into a tool holder, between which and the end of the cylinder is a spiral spring to absorb any abnormal shocks, or, in other words, to take the impact of the piston in the event that the tool shank slips out of its holder.

Pneumatic Rivet Head Cutter, Weight 71 Pounds, Handled by Three Men

At the bottom of the cylinder is an exhaust port connecting with a pipe that leads back to the valve chamber at the top of the machine. This pipe serves also as one of the handles for the operators. By using a three-way valve the operator can reverse the pressure and force the piston back to the head of the cylinder, where another exhaust port is provided. A quick turn of the valve again forces the piston forward.

The machine operates successfully on air pressure of from 45 to 125 pounds. It is also used for punching holes in plates preparatory to reaming them to the correct size. In straightening sheets, the blunt end of a 1½-inch bar is simply placed against the sheet, and the machine started, which drives the sheet back into its original position. On ⅝-inch countersunk rivets in some places they are simply backing them out without cutting the countersunk head off. This saves time, and is done much faster than it originally was by the old method of drilling the head off.

Shipbuilding plants are using this tool for cutting off ¾-inch, 1-inch and 1¼-inch rivets on the hull of the ship, and then the backing out of these rivets is very easily accomplished with the tool. The advantage of this tool is about ten to one as against the bar and sledge on straight work.

Former Seattle Shipbuilder Organizes Two New Shipyards in Vancouver

J. V. Paterson, formerly president of the Seattle Construction & Dry Dock Company, Seattle, Wash., has been successful in the organization of the Vancouver Dry Docks, Ltd., and another corporation known as the British Pacific Engineering Company, both having their headquarters and sites for plants at Vancouver, B. C.

The British Pacific Engineering Company already has a contract for six submarines for one of the allied governments, and for those vessels steel has been provided and is either on the ground or on the way. Work is progressing most satisfactorily on the erection of the plant, and the first vessels contracted for are now under construction. It is likewise anticipated that other vessels, including merchantmen, will be under way shortly.

Full plans for the establishment of the Vancouver Dry Docks, Ltd., have not been completed, but an immense dry-dock capable of lifting the largest vessels will be built at the site, which will be convenient to all rail and water transportation lines of the British Columbia metropolis. In addition this company will have a new and strictly modern ship repair plant and will actively enter into that feature of maritime commerce.

PERSONAL

HERBERT CHRISTOPHERSON, East Orange, N. J., has been appointed a member of the Naval Architect Board of the Government, in charge of ports between New London, Conn., and Barnegat, N. J., to arrange for the remodeling of yachts and pleasure boats for war service.

HENRY J. HARTLEY, superintendent of the boiler department of the William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., has retired from active duty. Mr. Hartley has been connected with the boiler department of the Cramp shipyard for the past fifty years, and since its organization he has taken an active part in the proceedings of the American Boiler Manufacturers' Association. Mr. Hartley was a recognized authority on the construction of marine boilers, and his work in this field is well known, not only in the United States but also abroad. Mr. Hartley is succeeded by his nephew, Victor Hartley, who has been appointed foreman of the boiler department at the Cramp shipyard.

THOMAS BENSON, formerly president of the Standard Shipbuilding Company, New York, has been elected vice-president and general manager of the Maryland Shipbuilding Company, Baltimore, Md. Mr. Benson was with the Harlan & Hollingsworth Corporation, Wilmington, Del., for twenty-five years, during that time rising to the position of general superintendent of the yard. Later he became chief engineer of the floating equipment of the Baltimore, Chesapeake & Atlantic and the Maryland, Delaware & Virginia Railways.

Major General George W. Goethals, general manager of the United States Shipping Board Emergency Fleet Corporation, announces his association with Messrs. Charles C. Jamieson, George H. Houston, Robert E. Graham, John C. Jay, Jr., and George M. Wells, consulting engineers, 40 Wall street, New York. The name of the firm will be Goethals, Jamieson, Houston and Jay, Inc.

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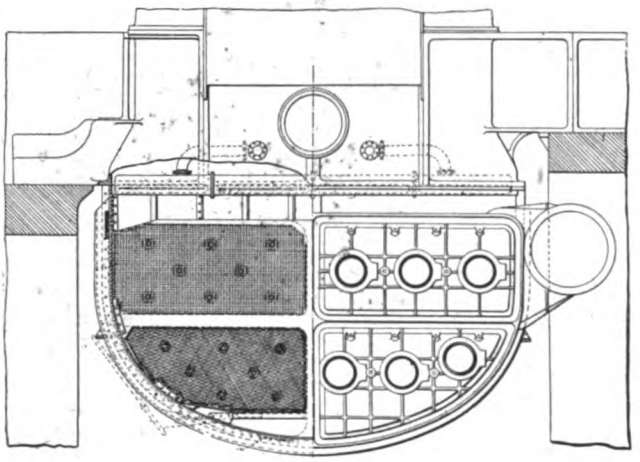
SELECTED MARINE PATENTS

The publication in this column of a patent specification does not necessarily imply editorial commendation.

American patents, compiled by Delbert H. Decker, Esq., registered patent attorney, Millerton, N. Y.

1,207,070. TURBINE INSTALLATION. CHARLES ALGERNON PARSONS, OF NEWCASTLE-UPON-TYNE, ENGLAND.

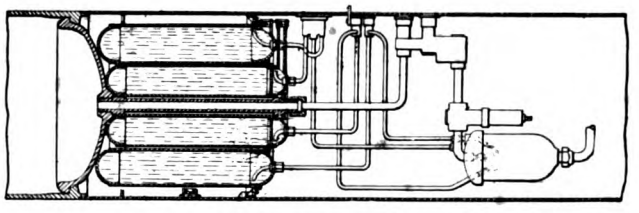
Claim 1.—An elastic fluid operated plant comprising in combination a low pressure turbine, supporting means separated by a space which is bridged by the casing of said turbine, a condenser receiving the working fluid discharged from the turbine, said condenser being situated in



the space below the turbine, means by which the condenser is suspended from the turbine casing, and preheating means partly within said turbine casing adapted to be impinged upon by the working fluid passing from the turbine to the condenser. Seven claims.

1,207,333. TORPEDO CONSTRUCTION. HAROLD W. SHONNARD, OF UPPER MONTCLAIR, N. J., ASSIGNOR TO CRUCIBLE STEEL COMPANY OF AMERICA, OF PITTSBURG, PA., A CORPORATION OF NEW JERSEY.

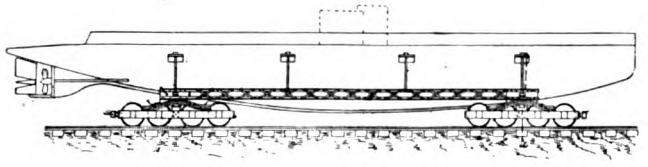
Claim 8.—In a torpedo, the combination of a shell, a compressed gas flask, a conduit leading from the flask substantially centrally of the torpedo shell, concentric annular fuel and water reservoirs surrounding said conduit, an inwardly-extending flange secured to said shell,



an outwardly-extending flange secured to the periphery of the outer reservoir and adapted to engage said shell flange, an outwardly-extending flange secured to the periphery of the inner reservoir and adapted to engage the outer reservoir, and a clamp adjustable upon said conduit and adapted to engage the inner reservoir and to thereby hold said several flanges in interlocking and reservoir-retaining positions. Eleven claims.

1,219,647. APPARATUS FOR TRANSPORTING SUBMARINE TORPEDO BOATS OVERLAND. SIMON LAKE, OF MILFORD, CONN., ASSIGNOR TO THE LAKE TORPEDO BOAT COMPANY OF MAINE, OF BRIDGEPORT, CONN., A CORPORATION OF MAINE.

Claim 1.—Apparatus for transporting boats overland, comprising wheeled trucks having bolsters provided with bearings, cradles pivotally

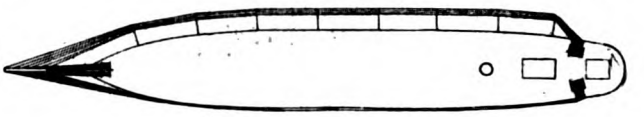


mounted upon said trucks by means of journals thereon fitted in the bearings on the bolsters and having a laterally loose connection therewith by king bolts, thereby to permit a limited lateral swinging motion of the cradles on the trucks, longitudinal frames connected to said cradles, and means to detachably secure a boat to the cradles and frames. Seven claims.

British patents compiled by G. F. Redfern & Co., chartered patent agents and engineers, 15 South street, Finsbury, E. C., and 10 Gray's Inn place, W. C., London.

103,430. DEVICES FOR PROTECTING VESSELS AT SEA. P. J. D. DERKER, OF 108 LAAN VAN NEERDERVOORT, THE HAGUE, HOLLAND, AND J. EINDHOVEN, OF 54 RUE ST. LAZARE, PARIS, FRANCE.

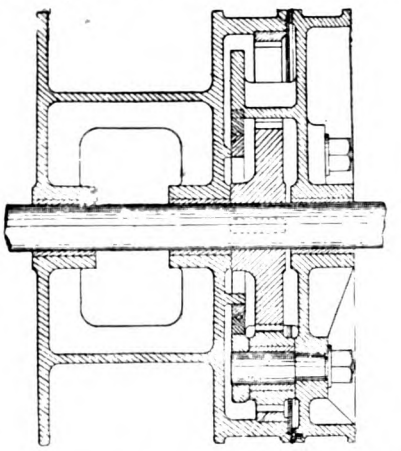
This invention relates to those devices for protecting vessels at sea against mines which comprise horizontal cables stretched from bow to stern and connected at relatively large distances by vertical



cables attached to suitable brackets or booms. According to this invention the horizontal cables are tensioned by suitable winding devices at their ends, so that they are situated in a concave surface, as seen in a direction looking towards the vessel.

17,680/15. RELATING TO FRICTIONAL BRAKE AND CLUTCH MECHANISM FOR SHIPS' WINCHES. G. T. MACFARLANE, OF INNAMINCHA, CANNONS LANE, PINNER.

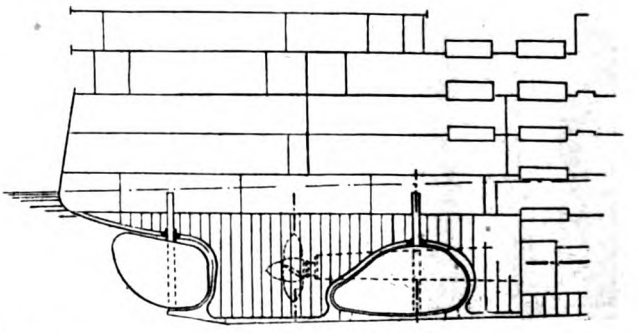
This invention has for its object to provide a winch in which the operations of raising and lowering loads can be effected with none or but little shock. For this purpose, in a winch comprising a barrel



and epicyclic gearing through which power is transmitted to the barrel, the braking of the epicyclic gearing drum is effected by means comprising a drum and a rope wound several times around the drum, one end of such rope being anchored and the other having a tightening pressure applied thereto, and overhauling of the barrel is obtained by bringing the drums into driving engagement one with the other, when braking restraint thereon is removed. The planet pinions of the epicyclic gearing are supported from the winch barrel as well as from the drum that carries them.

103,373/16. SHIPS WITH DOUBLE RUDDERS. E. C. R. MARKS, OF 57 AND 58, LINCOLN'S INN FIELDS, LONDON, W. C.

This invention has for its object to provide an improved arrangement of rudders in ships, and it consists in arranging two rudders in such a manner that while satisfying the requisite conditions for reducing the diameter of the turning circle of the ship, as well as the conditions for allowing the rudder to turn even through an angle



of 90 degrees relatively to the plane of symmetry, the improved arrangement will enable the ship to retain its original longitudinal profile. The aft rudder is arranged in the usual manner, whereas the forward rudder is pivoted in a recess formed in the longitudinal plane of the ship, with a contour approximately the same as that of the rudder itself. Between the rudders there is a thinned portion of the ship's bottom which serves as a support for that part of the hull situated between the two rudders. In order to facilitate the mounting and removal of the forward rudder, part of the keel may be removably attached to the hull by means of scarfing or fish plates and bolts.

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